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<b>Date of mailing</b> (day/month/year) 26 July 2000 (26.07.00)	
<b>International application No.</b> PCT/US99/26125	<b>Applicant's or agent's file reference</b> 32095-PCT
<b>International filing date</b> (day/month/year) 05 November 1999 (05.11.99)	<b>Priority date</b> (day/month/year) 06 November 1998 (06.11.98)
<b>Applicant</b> PAEK, Seungyup et al	

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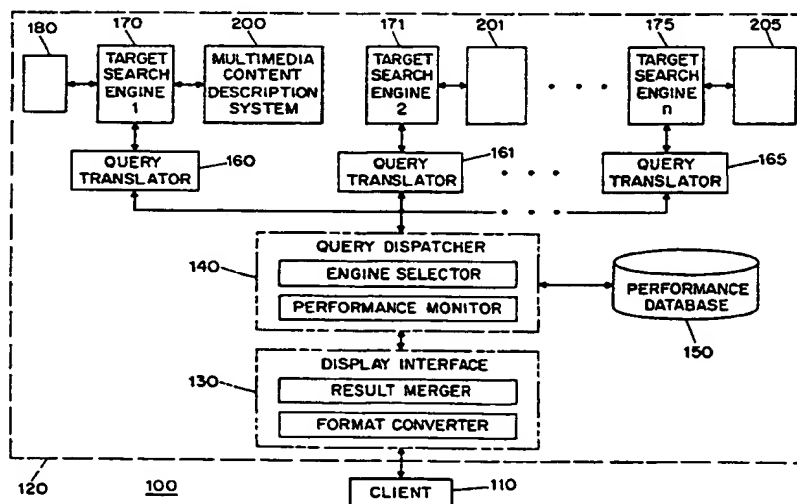
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US99/26125 (22) International Filing Date: 5 November 1999 (05.11.99) (30) Priority Data: 60/107,463 6 November 1998 (06.11.98) US (71) Applicant (for all designated States except US): THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK [US/US]; Broadway & 116th Street, New York, NY 10027 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): PAEK, Seungyup [KR/US]; 530 Riverside Drive, Apt. 6J, New York, NY 10027 (US). BENITEZ, Ana [ES/US]; 400 West 119th Street, Apt. 9F, New York, NY 10027 (US). CHANG, Shih-Fu [-/US]; 560 Riverside Drive, Apt. 18K, New York, NY 10027 (US). (74) Agent: TANG, Henry; Baker & Botts, LLP, 30 Rockefeller Plaza, New York, NY 10112-0228 (US).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  Published With international search report. With amended claims.  Date of publication of the amended claims: 6 July 2000 (06.07.00)	

(54) Title: SYSTEMS AND METHODS FOR INTEROPERABLE MULTIMEDIA CONTENT DESCRIPTIONS



## (57) Abstract

Systems and methods for generating standard description records from multimedia information are provided. The system includes at least one multimedia information input interface (180) receiving multimedia information, a computer processor, and a data storage system (150), operatively coupled to said processor, for storing said at least one description record. The processor performs object extraction processing to generate multimedia object descriptions (200, 201, 205) from the multimedia information, and object hierarchy processing (410, 420) to generate multimedia object hierarchy descriptions, to generate at least one description record including the multimedia object descriptions (200, 201, 205) and multimedia object hierarchy descriptions for content embedded within the multimedia information.

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/26125**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : G06F/1730

US CL : 707/10, 3, 4, 5, 104; 386/69; 395/806

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 707/10, 3, 4, 5, 104; 386/69; 395/806

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
WEST, EAST**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,613,032 A (CRUZ et al.) 18 March 1997, col. 3, line 30-col. 4, line 44).	1-43
Y	US 5,623,690 A (PALMER et al) 22 April 1997, col. 1, lines 52-66.	1-43
Y	US 5,630,121 A (BRADEN-HARDER et al.) 13 May 1997, col. 2, line 54-col. 3, line 28.	1-43
Y	US 5,696,964 A (COX et al) 09 December 1997, col. 1, lines 8-11.	1
Y	US 5,701,510 A (JOHNSON et al) 23 December 1997, col. 1, line 51-col. 2, line 17.	1-43
Y	US 5,713,021 A (KONDO et al) 27 January 1998, col. 1, line 55-col. 2, line 14.	1-43

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## INTERNATIONAL SEARCH REPORT

International application No.  
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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,758,076 A (WU et al) 26 May 1998, col. 1, lines 6-11.	1
Y	US 5,805,804 A (LAURSEN et al) 08 September 1998, col. 2, lines 14-38.	1-43
Y	US 5,822,524 A (CHEN et al) 13 October 1998, col. 3, line 40-col. 4, line 44.	1-43
Y	US 5,642,477 A (DE CARMO et al) 24 June 1997, col. 1, lines 10-14.	1
Y	US 5,713,021 A (KONDO et al) 27 January 1998, col. 1, line 56-col. 2, line 14.	1

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Description**SYSTEMS AND METHODS FOR INTEROPERABLE  
MULTIMEDIA CONTENT DESCRIPTIONS**Background of the Invention

## I. Field of the invention.

The present invention relates to techniques for describing multimedia information, and more specifically, to techniques which describe both video and image information as well as to content of such information.

## II. Description of the related art.

5 With the maturation of the global Internet and the widespread employment of regional networks and local networks, digital multimedia information has become increasingly accessible to consumers and businesses. Accordingly, it has become progressively more important to develop systems that process, filter, search and organize digital multimedia information, so that useful information can  
10 be culled from this growing mass of raw information.

At the time of filing the instant application, solutions exist that allow consumers and business to search for textual information. Indeed, numerous text-based search engines, such as those provided by yahoo.com, goto.com, excite.com and others are available on the World Wide Web, and are among the  
15 most visited Web sites, indicating the significant of the demand for such information retrieval technology.

Unfortunately, the same is not true for multimedia content, as no generally recognized description of this material exists. In this regard, there have been past attempts to provide multimedia databases which permit users to search for pictures using characteristics such as color, texture and shape information of video objects embedded in the picture. However, at the closing of the 20th Century, it is not yet possible to perform a general search the Internet or most regional or local networks for multimedia content, as no broadly recognized description of this material exists. Moreover, the need to search for multimedia content is not limited to databases, but extends to other applications, such as digital broadcast television and multimedia telephony.

One industry wide attempt to develop such standard a multimedia description framework has been through the Motion Pictures Expert Group's ("MPEG") MPEG-7 standardization effort. Launched in October 1996, MPEG-7 aims to standardize content descriptions of multimedia data in order to facilitate content-focused applications like multimedia searching, filtering, browsing and summarization. A more complete description of the objectives of the MPEG-7 standard are contained in the International Organisation for Standardisation document ISO/IEC JTC1/SC29/WG11 N2460 (Oct. 1998), the content of which is incorporated by reference herein.

The MPEG-7 standard has the objective of specifying a standard set of descriptors as well as structures (referred to as "description schemes") for the descriptors and their relationships to describe various types of multimedia information. MPEG-7 also proposes to standardize ways to define other descriptors as well as "description schemes" for the descriptors and their relationships. This description, i.e. the combination of descriptors and description schemes, shall be associated with the content itself, to allow fast and efficient searching and filtering for material of a user's interest. MPEG-7 also proposes to standardize a language to specify description schemes, i.e. a Description Definition Language ("DDL"), and the schemes for binary encoding the descriptions of multimedia content.

At the time of filing the instant application, MPEG is soliciting proposals for techniques which will optimally implement the necessary description schemes for future integration into the MPEG-7 standard. In order to provide such optimized description schemes, three different multimedia-application  
5 arrangements can be considered. These are the distributed processing scenario, the content- exchange scenario, and the format which permits the personalized viewing of multimedia content.

Regarding distributed processing, a description scheme must provide the ability to interchange descriptions of multimedia material independently of any  
10 platform, any vendor, and any application, which will enable the distributed processing of multimedia content. The standardization of interoperable content descriptions will mean that data from a variety of sources can be plugged into a variety of distributed applications, such as multimedia processors, editors, retrieval systems, filtering agents, etc . Some of these applications may be provided by third  
15 parties, generating a sub-industry of providers of multimedia tools that can work with the standardized descriptions of the multimedia data.

A user should be permitted to access various content providers' web sites to download content and associated indexing data, obtained by some low-level or high-level processing, and proceed to access several tool providers' web sites to  
20 download tools (e.g. Java applets) to manipulate the heterogeneous data descriptions in particular ways, according to the user's personal interests. An example of such a multimedia tool will be a video editor. A MPEG-7 compliant video editor will be able to manipulate and process video content from a variety of sources if the description associated with each video is MPEG-7 compliant. Each  
25 video may come with varying degrees of description detail, such as camera motion, scene cuts, annotations, and object segmentations.

A second scenario that will greatly benefit from an interoperable content description standard is the exchange of multimedia content among heterogeneous multimedia databases. MPEG-7 aims to provide the means to express, exchange,  
30 translate, and reuse existing descriptions of multimedia material.

Currently, TV broadcasters, Radio broadcasters, and other content providers manage and store an enormous amount of multimedia material. This material is currently described manually using textual information and proprietary databases. Without an interoperable content description, content users need to invest  
5 manpower to translate manually the descriptions used by each broadcaster into their own proprietary scheme. Interchange of multimedia content descriptions would be possible if all the content providers embraced the same scheme and content description schemes. This is one of the objectives of MPEG-7.

Finally, multimedia players and viewers that employ the description  
10 schemes must provide the users with innovative capabilities such as multiple views of the data configured by the user. The user should be able to change the display's configuration without requiring the data to be downloaded again in a different format from the content broadcaster.

The foregoing examples only hint at the possible uses for richly structured  
15 data delivered in a standardized way based on MPEG-7. Unfortunately, no prior art techniques available at present are able to generically satisfy the distributed processing, content-exchange, or personalized viewing scenarios. Specifically, the prior art fails to provide a technique for capturing content embedded in multimedia information based on either generic characteristics or semantic relationships, or to  
20 provide a technique for organizing such content. Accordingly, there exists a need in the art for efficient content description schemes for generic multimedia information.

#### Summary of the Invention

An object of the present invention is to provide content description schemes  
25 for generic multimedia information.

Another object of the present invention is to provide techniques for implementing standardized multimedia content description schemes.

A further object of the present invention is to provide an apparatus which permits users to perform general searches on the Internet or regional or local networks for multimedia content.

5 Still another object of the present invention is to provide a technique for capturing content embedded in multimedia information based on either generic characteristics or semantic relationships,

Still a further object of the present invention is to provide a technique for organizing content embedded in multimedia information based on either generic characteristics or semantic relationships.

10 In order to meet these and other objects which will become apparent with reference to further disclosure set forth below, the present invention provides a system for generating a description record from multimedia information. The system includes at least one multimedia information input interface receiving multimedia information, a computer processor, and a data storage system,  
15 operatively coupled to said processor, for storing said at least one description record. In order to satisfy the objectives of the present invention, the processor performs object extraction processing to generate multimedia object descriptions from the multimedia information, and object hierarchy processing to generate multimedia object hierarchy descriptions, to generate at least one description record  
20 including the multimedia object descriptions and multimedia object hierarchy descriptions for content embedded within the multimedia information

In a preferred arrangement, the multimedia information is image information, the multimedia object descriptions are image object descriptions, and the multimedia hierarchy object descriptions are image object hierarchy  
25 descriptions. In an alternative preferred arrangement, the multimedia information is video information, the multimedia object descriptions are video object descriptions, and the multimedia object hierarchy descriptions are video object hierarchy descriptions.

Where the multimedia information is image information, it is highly  
30 preferred that the object extraction processing includes image segmentation

processing to segment each image in the image information into regions, and feature extraction processing to generate one or more feature descriptions for one or more of the regions. The descriptions may include text annotations, color, texture, shape, size, and position information.

5           Likewise, it is advantageous for the object hierarchy processing to include physical object hierarchy organization to generate physical object hierarchy descriptions of the image object descriptions that are based on spatial characteristics of the objects, and logical object hierarchy organization to generate logical object hierarchy descriptions of the image object descriptions that are based on semantic characteristics of the objects, such that the image object hierarchy descriptions comprise both physical and logical descriptions. An encoder may be added to the system for encoding the image object descriptions and image object hierarchy descriptions into compressed description information.

10           Where the multimedia information is video information, it is highly preferred that the object extraction processing includes video segmentation processing to temporally segment the video information into one or more video events or groups of events, video object extraction processing to segment the video events into regions and generate feature descriptions for the regions; and feature extraction processing to generate one or more feature descriptions for the video events. The feature descriptions for events may include text annotations, shot transition, camera motion, time, and key frame. The feature descriptions for objects may include text annotations, color, texture, shape, size, position, motion, and time.

15           Likewise, it is advantageous for the object hierarchy processing to include both physical event and object hierarchy organization to generate physical event and object hierarchy descriptions of the video event and object descriptions that are based on temporal characteristics of the video events and objects, and logical event and object hierarchy organization to generate logical event and object hierarchy descriptions of the video event and object descriptions that are based on semantic characteristics of said the objects, and video object hierarchy extraction processing



to generate hierarchy descriptions for events and objects embedded within the video information.

The present invention also provides methods to provide a content description scheme for generic multimedia information. In one arrangement, the method includes the steps of receiving multimedia information, processing the multimedia information by performing object extraction processing to generate multimedia object descriptions; processing the generated multimedia object descriptions by object hierarchy processing to generate multimedia object hierarchy descriptions, so that at least one description record including the object descriptions and the hierarchy objects descriptions is generated for content embedded within the multimedia information; and storing the record. The multimedia information may be image or video information.

The present invention further provides computer readable media containing digital information with at least one multimedia description record describing multimedia content for corresponding multimedia information. In one arrangement, the media includes at least one object description for corresponding objects embedded in the multimedia information, one or more features characterizing each of the objects; and any available hierarchy information relating at least a portion of the objects in accordance with at least one of the features. The multimedia information may be image or video information, and where video information, the objects may be events or video objects embedded within the video information.

The accompanying drawings, which are incorporated and constitute part of this disclosure, illustrate a preferred embodiment of the invention and serve to explain the principles of the invention.

#### Brief Description of the Drawings

Fig. 1 is a system diagram of a preferred embodiment of the present invention;

Fig. 2 is a functional diagram of a multimedia content description system suitable for employment in the system of Fig. 1;

Fig. 3 is an illustrative diagram of an image showing exemplary image objects;

Figs. 4a and 4b are illustrative diagrams showing a set of image objects and exemplary hierarchal organizations for the exemplary image objects shown in Fig. 3;

Fig. 5 is an illustrative diagram of a video showing exemplary video events;

Figs. 6a and 6b are illustrative diagrams showing a set of video events and an exemplary hierarchal organization for the exemplary video objects shown in Fig. 5;

Fig. 7 is a flow diagram of a process which may be implemented in the system of Fig. 1 to generate image descriptions; and

Fig. 8 is a flow diagram of a process which may be implemented in the system of Fig. 1 to generate video descriptions.

#### Description of the Preferred Embodiments

Referring to Fig. 1, an exemplary embodiment of the present invention is provided. The architecture of the system 100 includes a client computer 110 and a server computer 120. The server computer 120 includes a display interface 130, a query dispatcher 140, a performance database 150, query translators 160, 161, 165, target search engines 170, 171, 175, an additional client computer 180, and multimedia content description systems 200, 201, 205, which will be described in further detail below.

While the following disclosure will make reference to this exemplary client-server embodiment, those skilled in the art should understand that the particular system arrangement may be modified within the scope of the invention to include numerous well-known local or distributed architectures. For example, all functionality of the client-server system could be included within a single

computer, or a plurality of server computers could be utilized with shared or separated functionality. The multimedia content description systems 200, 201, 205, are preferably software routines executing on a general purpose processor within the server computer 120.

Commercially available metasearch engines act as gateways linking users automatically and transparently to multiple text-based search engines. The system of Fig. 1 grows upon the architecture of such metasearch engines and is designed to intelligently select and interface with multiple on-line multimedia search engines by ranking their performance for different classes of user queries. Accordingly, the query dispatcher 140, query translators 160, 161, 165, and display interface 130 of commercially available metasearch engines may be employed in the present invention.

The dispatcher 140 selects the target search engines to be queried by consulting the performance database 150 upon receiving a user query. This database 150 contains performance scores of past query successes and failures for each supported search option. The query dispatcher only selects search engines 170, 171, 175 that are able to satisfy the user's query, e.g. a query seeking color information will trigger color enabled search engines.

The query translators 160, 161, 165, translate the user query to suitable scripts conforming to the interfaces of the selected search engines. The display component 130 uses the performance scores to merge the results from each search engine, and presents them to the user.

In accordance with the present invention, in order to permit a user to intelligently search the Internet or a regional or local network for multimedia content, search queries may be made with respect to the content embedded in multimedia information. Content based search queries may be made by descriptions of multimedia content in accordance with description schemes of the present invention, by example or by sketch. Each search engine 170, 171, 175 employs a description scheme, for example the description schemes described

below, to describe the contents of multimedia information accessible by the search engine and to implement the search.

In order to implement a content-based search query for multimedia information generated via client computer 110, the dispatcher 140 will match the query description, through a the multimedia content description system 200, employed by each search engine 170, 171, 175 to ensure the satisfaction of the user preferences in the query. It will then select the target search engines 170, 171, 175 to be queried by consulting the performance database 150. If the user of client computer 110 wants to search by color and one search engine does not support any color descriptors, it will not be useful to query that particular search engine.

Next, the query translators 160 will adapt the query description to descriptions conforming to each selected search engine. This translation will also be based on the description schemes available from each search engine. This task may require executing extraction code for standard descriptors or downloaded extraction code from specific search engines to transform descriptors. For example, if the user specifies the color feature of an object using a color coherence of 166 bins, the query translator will translate it to the specific color descriptors used by each search engine, e.g. color coherence and color histogram of x bins.

Before displaying the results to the user, the query interface will merge the results from each search option by translating all the result descriptions into a homogeneous one for comparison and ranking. Again, similarity code for standard descriptors or downloaded similarity code from search engines may need to be executed. User preferences will determine how the results are displayed to the user.

Alternatively, a search query can be entered via client computer 180 which directly interfaces with target search engine 170. Unlike a query entered through client computer 110, client computer 180 will not enable a metasearch via multiple search engines. However, the multimedia content description system 200 may be employed in either arrangement to conduct a content based search in accordance with the present invention.

Referring next to Fig. 2, a description system 200 which, in accordance with the present invention, is employed by each search engine 170. 171, 175 is now described. In the preferred embodiment disclosed herein, the Extensible Markup Language ("XML") is used to describe multimedia content. XML is a subset of the Standard Generalized Markup Language ("SGML"), the standard language for defining and using document formats. SGML allows documents to be self-describing, i.e. they describe their own grammar by specifying the tag set used in the document and the structural relationships that those tags represent. XML retains the key SGML advantages in a language that is designed to be vastly easier to learn, use, and implement than full SGML. A complete description of XML can be found at the World Wide Web Consortium's web page on XML, at <http://www.w3.org/XML/>, the contents of which is incorporated by reference herein.

The description system 200 advantageously includes several image and video processing, analysis and annotation sub-systems 210, 220, 230, 240, 250, 260, 270, 280 to generate a rich variety of descriptions for a collection of image and video items 205. Each subsystem is described in turn.

The first subsystem 210 is a region-based indexing and searching system which extracts visual features such as color, texture, motion, shape, and size for automatically segmented regions of a video sequence. The system 210 decomposes video into separate shots by scene change detection, which may be either abrupt or transitional (e.g. dissolve, fade in/out, wipe). For each shot, the system 210 estimates both global (i.e. the motion of dominant background), and camera motion, then segments, detects, and tracks regions across the frames in the shot computing different visual features for each region. For each shot, the description generated by this system is a set of regions with visual and motion features, and the camera motion. A complete description of the region-based indexing and searching system 210 is contained in co-pending PCT Application Serial No. PCT/US98/09124, filed May 5, 1998, entitled "An Algorithm and

System Architecture for Object-Oriented Content-Based Video Search," the contents of which are incorporated by reference herein.

As used herein, a "video clip" shall refer to a sequence of frames of video information having one or more video objects having identifiable attributes, such as, by way of example and not of limitation, a baseball player swinging a bat, a surfboard moving across the ocean, or a horse running across a prairie. A "video object" is a contiguous set of pixels that is homogeneous in one or more features of interest, e.g., texture, color, motion and shape. Thus, a video object is formed by one or more video regions which exhibit consistency in at least one feature. For example a shot of a person (the person is the "object" here) walking would be segmented into a collection of adjoining regions differing in criteria such as shape, color and texture, but all the regions may exhibit consistency in their motion attribute.

The second subsystem 220 is an MPEG domain face detection system, which efficiently and automatically detects faces directly in the MPEG compressed domain. The human face is an important subject in video. It is ubiquitous in news, documentaries, movies, etc., providing key information to the viewer for the understanding of the video content. This system provides a set of regions with face labels. A complete description of the system 220 is contained in PCT Application Serial No. PCT/US 97/20024, filed November 4, 1997, entitled "A Highly Efficient System for Automatic Face Region Detection in MPEG Video," the contents of which are incorporated by reference herein.

The third subsystem 230 is a video object segmentation system in which automatic segmentation is integrated with user input to track semantic objects in video sequences. For general video sources, the system allows users to define an approximate object boundary by using a tracing interface. Given the approximate object boundary, the system automatically refines the boundary and tracks the movement of the object in subsequent frames of the video. The system is robust enough to handle many real-world situations that are hard to model in existing approaches, including complex objects, fast and intermittent motion, complicated

backgrounds, multiple moving objects and partial occlusion. The description generated by this system is a set of semantic objects with the associated regions and features that can be manually annotated with text. A complete description of the system 230 is contained in U.S. Patent Application Serial No. 09/405,555, filed September 24, 1998, entitled "An Active System and Algorithm for Semantic Video Object Segmentation," the contents of which are incorporated by reference herein.

The fourth subsystem 240 is a hierarchical video browsing system that parsers compressed MPEG video streams to extract shot boundaries, moving objects, object features, and camera motion, and. It also generates a hierarchical shot-based browsing interface for intuitive visualization and editing of videos. A complete description of the system 240 is contained in PCT Application Serial No. PCT/US 97/08266, filed May 16, 1997, entitled "A Method and Architecture for Indexing and Editing Compressed Video Over the World Wide Web," the contents of which are incorporated by reference herein.

The fifth subsystem 250 is the entry of manual text annotations. It is often desirable to integrate visual features and textual features for scene classification. For images from on-line news sources, e.g. Clarinet, there is often textual information in the form of captions or articles associated with each image. This textural information can be included in the descriptions.

The sixth subsystem 260 is a system for high-level semantic classification of images and video shots based on low-level visual features. The core of the system consists of various machine learning techniques such as rule induction, clustering and nearest neighbor classification. The system is being used to classify images and video scenes into high level semantic scene classes such as {nature landscape}, {city/suburb}, {indoor}, and {outdoor}. The system focuses on machine learning techniques because we have found that the fixed set of rules that might work well with one corpus may not work well with another corpus, even for the same set of semantic scene classes. Since the core of the system is based on machine learning techniques, the system can be adapted to achieve high

performance for different corpora by training the system with examples from each corpus. The description generated by this system is a set of text annotations to indicate the scene class for each image or each keyframe associated with the shots of a video sequence. A complete description of the system 260 is contained in S. Paek et al., "Integration of Visual and Text based Approaches for the Content Labeling and Classification of Photographs," ACM SIGIR'99 Workshop on Multimedia Indexing and Retrieval. Berkeley, C A (1999), the contents of which are incorporated by reference herein.

The seventh subsystem 270 is model based image classification system. Many automatic image classification systems are based on a pre-defined set of classes in which class-specific algorithms are used to perform classification. The system 270 allows users to define their own classes and provide examples that are used to automatically learn visual models. The visual models are based on automatically segmented regions, their associated visual features, and their spatial relationships. For example, the user may build a visual model of a portrait in which one person wearing a blue suit is seated on a brown sofa, and a second person is standing to the right of the seated person. The system uses a combination of lazy-learning, decision trees and evolution programs during classification. The description generated by this system is a set of text annotations, i.e. the user defined classes, for each image. A complete description of the system 270 is contained in A. James et al., "Model Based Classification of Visual Information for Content-Based Retrieval," Symp. Elec. Imaging: Multimedia Proc. and App. - Storage Retrieval and for Image and Video Databases VII, IS&T/SPIE '99 (1999), the contents of which are incorporated by reference herein.

Other subsystems 280 may be added to the multimedia content description system 200, e.g., a subsystem used by collaborators to generate descriptions.

In operation, the image and video content 205 may be a database of still images or moving video, a buffer receiving content from a browser interface 206, or a receptacle for live image or video transmission. The subsystems 210, 220, 230, 240, 250, 260, 270, 280 operate on the image and video content 205 to



generate descriptions 211, 221, 231, 241, 251, 261, 271, 281 that include low level visual features of automatically segmented regions, user defined semantic objects, high level scene properties, classifications and associated textual information, as described above. Once all the descriptions for an image or video item are generated and integrated 290, the descriptions are input into a database 295, which the search engine 170 accesses.

The process implemented by the subsystem 210, 220, 230, 240, 250, 260, 270, 280 to generate descriptions 211, 221, 231, 241, 251, 261, 271, 281 in a standard format are described below with reference to Figs. 7-8. It should be noted that certain of the subsystems, i.e., the region-based indexing and searching subsystem 210 and the video object segmentation system 230 may implement the entire description generation process, while the remaining subsystems implement only portions of the process and may be called on by the subsystems 210, 230 during processing. In a similar manner, the subsystems 210 and 230 may be called on by each other for specific tasks in the process.

The standard description schemes for images will now be described with reference to Figs. 3-4. Referring to Fig. 3, an exemplary image 300 with three persons is shown. The <object> element is the fundamental description element. Each <object> element has an identifier that is unique within a given image description. The identifier is expressed as an attribute of the <object> element e.g. <object id="1">. The <object> element also requires an attribute named type to distinguish between physical objects and logical objects. Physical objects usually correspond to continuous regions of the image with some descriptors in common (features, semantics, etc.) - in other words, real objects in the image. Logical objects are groupings of objects based on some high-level semantic relationships (e.g. faces or people). The <object> elements may also include two more attributes, object\_ref and object\_node\_ref. The former allows deriving one object from an existing one, and the latter links back to nodes in the object hierarchy. The set of all objects identified in an image is included within the object set element (<object\_set>).

Nine exemplary objects are shown in Fig. 3, including the entire family portrait 300, father 310, mother 320, child 330, parents 340, children 350, faces 360, father's face 311, mother's face 321. These objects may be expressed as a set of objects 0, 1, 2, 3, 4, 5, 6, 7, 8, as shown in Fig. 4a, with the entire family portrait 300 being object 0, the father 310 being object 1, the mother 320 being object 2, child 330 being object 3, parents 340 being object 4, children 350 being object 5, faces 360 being object 6, the father's face 311 being object 7 and the mother's face 321 being object 8. In this example, the identified objects are each physical objects with the exception of faces 360, which is a logical object. In XML, these image objects may be expressed as follows:

```
<object_set>
<!-- Family portrait -->
<object id="0" type="PHYSICAL"> ... </object>
<!-- Father -->
<object id="1" type="PHYSICAL"> ... </object>
<!-- Mother -->
<object id="2" type="PHYSICAL"> ... </object>
<!-- Son -->
<object id="3" type="PHYSICAL"> ... </object>
<!-- Parents -->
<object id="4" type="PHYSICAL"> ... </object>
<!-- Children -->
<object id="5" type="PHYSICAL"> ... </object>
<!-- Faces -->
<object id="6" type="LOGICAL"> ... </object>
<!-- Father's face -->
<object id="7" type="PHYSICAL"> ... </object>
<!-- Mother's face -->
<object id="8" type="PHYSICAL"> ... </object>
</object_set>
```

In the XML description, each object element has a unique identifier within an image description. The identifier is expressed as an attribute of the object element (id). Another attribute of the object element (type) distinguishes between physical and logical objects. The content of each object element has been left empty to illustrate the overall structure of the image description.

The image description scheme is comprised of object elements that are combined hierarchically in one or more object hierarchy elements (<object\_hierarchy>). The hierarchy is a way to organize the object elements in the object set element. Each object hierarchy consists of a tree of object node elements (<object\_node>). Each object node points to an object.

The objects in an image can be organized by their location in the image or by their semantic relationships. These two ways to group objects generate two types of hierarchies: physical and logical hierarchies. A physical hierarchy describes the physical location of the objects in the image. On the other hand, a logical hierarchy organizes the objects based on a higher level understanding of their semantics, similar to semantic clustering.

Continuing with the image example of Fig. 3, two possible hierarchies are shown in Fig 4b, an object hierarchy which organizes objects physically 410 is shown, i.e., objects 4 and 5 are physically within object 0. A second object hierarchy which organizes objects logically 420 is shown, i.e., objects 7 and 8 are associated with object 6. In XML, these two hierarchies may be expressed as follows:

```
<object_hierarchy type="PHYSICAL">
```

```
<!-- Family portrait -->
```

```
<object_node id="9" object_ref="0">
```

```
<!-- Parents -->
```

```
<object_node id="10" object_ref="4">
```

```
<object_node id="11" object_ref="1">
```

```
<object_node id="12" object_ref="7"/>
```

```
</object_node>
```

```
<object_node id="13" object_ref="2">
```

```
<object_node id="14" object_ref="8"/>
```

```
</object_node>
```

```
</object_node>
```

```
<!-- Children -->
```

```
<object_node id="15" object_ref="5">
```

```
<object_node id="16" object_ref="3"/>
</object_node>
```

```
</object_node>
</object_hierarchy>
```

```
<object_hierarchy type="LOGICAL">
```

```
<!-- Faces -->
<object_node id="17" object_ref="6">
<object_node id="18" object_ref="7"/>
<object_node id="19" object_ref="8"/>
</object_node>
```

```
</object_node>
</object_hierarchy>
```

The type of hierarchy is included in the object hierarchy element as an attribute (type). The object node element has associated a unique identifier in the form of an attribute (id). The object node element references an object element by using the latter's unique identifier. The reference to the object element is included as an attribute (object\_ref). An object element can include links back to nodes in the object hierarchy as an attribute.

An object set element and one or more object hierarchy elements form the image element (<image>). The <object> elements in the <object\_set> element are combined hierarchically in a <object\_hierarchy> element. The attribute object\_node\_ref of <object> elements points to their corresponding nodes in the <object\_hierarchy> elements. On the other hand, the attribute event\_ref of <event\_node> elements references back to the <object> element.

An <object> element may contain an optional <location> element and the feature descriptor elements, such as <text\_annotation>, <color>, <texture>, <shape>, <size>, <position>, <motion>, and <time> elements. The <location> element contains a list of the physical locations of the image. The <time> and <motion> elements only have sense when the object belongs to a video sequence, to be described below. For example:

```

<!-- Father's face -->
<object id=" 7">
<location></location>
<text_annotation></text_annotation>
<color></color>
<shape></shape>
<position></position>
</object>

```

Appendix I presents the complete image description for the example image shown in Fig. 3. The image description scheme is summarized below in Table I.

TABLE I			
Element	Must Contain	May Contain	Can be Contained in
image	object_set	object_hierarchy(s)	(root element)
object_set	object(s)		image
object		location text_annotation color texture shape size position motion time	object_set
object_hierarchy	object_node		image
object_node		object_node(s)	object_hierarchy object_node(s)

The location element contains pointers to the locations of the image. Note that annotations can be textual, visual or multimedia. These features can be extracted or assigned automatically, semi-automatically or manually.

When features are extracted automatically, the feature descriptors could include links to extraction and similarity matching code, and may even include annotation elements from external descriptions, as shown in the following example:

```
<object id="4" type="PHYSICAL" object_node_ref="12 16"> <!-- Father's face
-->
<color> </color>
<texture>
<tamura>
<tamura_value coarseness="0.01" contrast="0.39" orientation="0.7"/>
<code type="EXTRACTION" language="JAVA" version="1.2">
<location> <location_site href="ftp://extraction.tamura.java"/> </location>
</code>
</tamura>
</texture>
<shape> </shape>
<position> </position>
<text_annotation xmlns:extAnDS="http://www.other.ds/annotation.elements">
<extAnDS:Object>Face</extAnDS:Object>
</text_annotation>
</object>
```

A second example, contained in Appendix II hereto, illustrates the content of a particular image, which may include one or more distinct objects, in terms of the features of those objects including the location where the image is stored, text annotations, i.e., the name of the picture, the names of the persons in the picture, the location where the picture was taken, the event that is represented by the picture, and the date of the picture, color features in terms of LUV color, texture features in terms of Tamura texture, and size or dimensions of the image. Thus, information concerning the entire picture, e.g., the location where the image is stored, is descriptive of the object "id=o0," which represents the entire image. Other information concerns other objects within the image. For object "id=o1," is particularly described in the example in terms of text annotation (including the name of the person), color, texture, shape using eigenvalue analysis, size, and position in terms of a segmentation mask analysis. For object "id=o2," only text

annotations are provided. Object "id=o3" is a logical object corresponding to the concept of faces.

The standard description schemes for video will now be described with reference to Figs. 5-6. Referring to Fig. 5, an exemplary video clip 500 with five temporal video events is shown. In the video description scheme, the <event> element is the fundamental description element. Each <event> element has an identifier that is unique within a given video DS description. The identifier is expressed as an attribute of the <event> element, e.g. <event id="1">.

The <event> element requires another attribute named type to distinguish different types of events. The attribute type can have three different values: shot, continuous\_group\_shots, and discontinuous\_group\_shots. Discontinuous group of shots will usually be associated together based on common features (e.g. background color) or high-level semantic relationships (e.g. actor on screen). The <event> elements may also include two more attributes, basic\_event\_ref and event\_node\_ref. The former allows deriving one event from an existing one, and the latter links back to nodes in the event hierarchy. The set of all events are found within the <event\_set> element.

Nine exemplary video events are shown in Fig. 5, including the entire video sequence 500, a scene where the tiger is stalking the prey 510, a scene where the tiger is chasing its prey 520, a scene where the tiger captures its prey 530, and a scene where the tiger is feeding 540. The later scene includes two events, one where the tiger is hiding the food 550, and the second where the tiger is feeding the young 560. These video events, which are parallel to image objects, may be expressed as a set of events 0, 1, 2, 3, 4, 5, 6, as shown in Fig. 6a, with the entire video sequence 500 being event 0, the scene where the tiger is stalking the prey 510 being event 1, the scene where the tiger is chasing its prey 520 being event 2, the scene where the tiger captures its prey 530 being event 4, the scene where the tiger is feeding 540 being event 4, the scene where the tiger is hiding the food 550 being event 5, and the scene where the tiger is feeding the young 560 being event 6. In this example, the identified events are each shots, with the exception of event

4, which is of the type continuous group shots. Non temporally aligned events such as events 1 and 3 could be organized into discontinuous group shots. In XML, these image objects may be expressed as follows:

```
<event_set>
<!-- The Tiger -->
<event id="0" type="SHOT"> ... </event>
<!-- Stalking the prey -->
<event id="1" type="SHOT"> ... </event>
<!-- The chase -->
<event id="2" type="SHOT"> ... </event>
<!--The capture -->
<event id="3" type="SHOT"> ... </event>
<!-- Feeding -->
<event id="4" type="CONTINUOUS_GROUP_SHOTS"> ... </event>
<!-- Feeding the young -->
<event id="5" type="SHOT"> ... </event>
<!-- Protecting the food -->
<event id="6" type="SHOT"> ... </event>
</event_set>
```

Note that each `<event>` element empty to clearly show the overall structure of the video description scheme. It is important to note that the selection and definition of an event in a given video is determined by the author of the description. The `<event>` element can correspond to either a shot or a scene of a video, or even a combination of these.

The video description scheme is basically comprised of `<event>` elements that are combined hierarchically in a `<event_hierarchy>` element. The `<event_hierarchy>` element must contain a single `<event_node>` element. The `<event_node>` contains zero or more `<event_node>` elements and zero or more `<object_hierarchy>` elements, as described above for the image description scheme. Each `<event_node>` element has associated a unique identifier. The identifier is expressed as an attribute of the elements e.g. `<event_node id="1">`. The hierarchy is a way to organize the `<event>` elements in the `<event_set>` element.



The different events that form a video sequence may be grouped or organized in two different ways: by their location in the video sequence or by their semantic relationships. The <event\_hierarchy> element includes an attribute, type, to distinguish between physical and logical hierarchies. A physical hierarchy will describe the temporal relationships of the events in the image. On the other hand, logical hierarchies will organize the events based on a higher level understanding of their semantics.

Each <event\_node> element consists of a reference to a <event> element, by using the unique identifiers associated with each <event>. The reference to the <event> element is given as an event\_ref attribute. The video of Fig. 5 has the hierarchy shown in figure 6b. This hierarchy is expressed in XML as follows:

```
<event_hierarchy type="PHYSICAL">
<!-- The Tiger -->
<event_node id="7" event_ref="0">
<!-- Stalking the prey -->
<event_node id="8" event_ref="1"/>
<!-- The chase -->
<event_node id="9" event_ref="2"/>
<!-- Capture -->
<event_node id="10" event_ref="3"/>
<!-- Feeding -->
<event_node id="11" event_ref="4">
<!-- Hiding the food -->
<event_node id="12" event_ref="5"/>
<!-- Feeding the young-->
<event_node id="13" event_ref="6"/>
</event_node>
</event_node>
</event_hierarchy>
```

An event set element and one or more even hierarchy elements form the video element (<video>). The video element symbolizes the video sequence being described. . The <event> elements in the <event\_set> element are combined hierarchically in a <event\_hierarchy> element. The attribute event\_node\_ref of <event> elements points to the corresponding nodes in the <event\_hierarchy>

elements. On the other hand, the attribute event\_ref of <event\_node> elements references back to the <event> element.

In the video description scheme, an <event> element can contain the following elements:

- <location> (optional)
- <transition> (optional)
- <text\_annotation> (optional)
- <object\_set> (optional)
- <camera\_motion>(optional)
- <time>(optional)
- <key\_frame>(zero or more)

The <object\_set> <text\_annotation> and the <location> elements are defined above with respect to the image description scheme. The <transition> element describes the transitions between shots. Thus, event 3 in the tiger video can be described as follows:

```
<!-- Capture -->
<event id="3">
  <text_annotation>
    <name_annotation>
      <concept>The capture of the prey</concept>
    </name_annotation>
  </text_annotation>
  <text_annotation> ... </text_annotation>
  <object_set> ... </object_set>
  <camera_motion> ... </camera_motion>
  <time> ... </time>
  <key_frame> ... </key_frame>
</event>
```

Appendix III presents the complete video description for the example image shown in Fig. 5.

In the video description scheme, the event element contains features including location, shot transition (i.e. various within shot or across shot special effects), camera motion, time, key frame, annotation and object set elements, among others. The object element is defined in the image description scheme; it

represents the relevant objects in the event. As in the image description, these features can be extracted or assigned automatically or manually. For those features extracted automatically, the feature descriptors can include links to extraction and similarity matching code. For example,

```
<event id="3" type="PHYSICAL" event_node_ref="10"> <!-- Capture -->
<object_set> </object_set>
<camera_motion>
<backgroun_affine_model>
<background_affine_motion_value>
<panning direction="NE"/>
<zoom direction="IN"/>
</background_affine_motion_value>
<code type="DISTANCE" language="JAVA" version="1.0">
<location> <location_site href="ftp://dist.bacground.affine"/> </location>
</code>
</background_affine_model>
</camera_motion>
<time> </time>
</event>
```

A second example contained in Appendix IV describes the content of a particular video sequence which may include one or more distinct events, in terms of the features of those events including the location where the video is stored, text annotations, i.e., the name of the video, the names of the persons in the video, the location where the video was taken, the event that is represented by the video, and the date of the video, the objects within that video sequence, the camera motion, the total time of the video sequence in terms of number of frames, and keyframes. This information concerning the entire video sequence is descriptive of the event id=E0. Other information concerns other objects within the image.

The event hierarchy used to organize the described content is a physical hierarchy and describes temporal relationships. In this case, the only event is id=E0 which corresponds to the entire video. Within that event, two hierarchies are used to described the objects within the event, i.e., a physical and logical hierarchy, and parallel the physical and logical hierarchies described previously for the image example.

The process implemented by the system 200 to generate the image and video descriptions described with reference to Figs. 3-6 shall now be described with reference to Figs. 7-8. Fig. 7 is a flow diagram which illustrates a preferred process for generating descriptions for images. Digital image data 710 is applied to the computer system via link 711. The image data may be non-compressed, or may be compressed in accordance with any suitable compression scheme, e.g., JPEG.

The computer system, under the control of suitable application software, first performs object extraction 720 on the image data 710, in order to generate image objects. Object extraction 720 may take the form of a fully automatic processing operation, a semi-automatic processing operation, or a substantially manual operation in which objects are defined primarily through user interaction, such as via a user input device.

In a preferred method, object extraction 720 consists of two subsidiary operations, namely image segmentation 725 and feature extraction and annotation 726. For the image segmentation 725 step, any region tracking technique which partitions digital images into regions that share one or more common characteristics may be employed. Likewise, for the feature extraction and annotation step 326, any technique which generates features from segmented regions may be employed. The region-based indexing and searching subsystem 210 described above is suitable for automated image segmentation and feature extraction; the video object segmentation system 230 described above is suitable example of a semi-automated image segmentation and feature extraction. Manual segmentation and feature extraction could alternatively be employed.

The object extraction processing 720 generates an image object set 721 and optional related features such as annotations (collectively "image object descriptions"), which are preferably further processed by an object hierarchy extraction and construction module 730. Alternatively, the objects 721 could be directly stored in a database 740, or encoded by an XML encoder 750 or a binary encoder 760 and then stored 751, 752 in database 740.

The object hierarchy extraction and construction module 730 operates on the image object descriptions to generate image object hierarchy descriptions 731. Preferably, both physical object hierarchy organization 735 and logical object hierarchy organization 736 are performed in parallel to generate descriptions 731. The region-based indexing and searching subsystem 210 described above is suitable for automated image object hierarchy construction; the video object segmentation system 230 described above is suitable example of a semi-automated object hierarchy construction. Manual object hierarchy construction could alternatively be employed.

The image object hierarchy descriptions 731 are either directly stored in a database 740, or are encoded by an XML encoder 750 or a binary encoder 760 and then stored 751, 752 in database 740 as an image description record. Once the image description records have been stored in data base storage 740, they remain available in a useful format for access and use by other applications 770, such as search, filter and archiving applications for example, via bidirectional link 771.

Fig. 8 is a flow diagram which illustrates a preferred process for generating descriptions for video. Digital video data 810 is applied to the computer system via link 811. The video data may be non-compressed, or may be compressed in accordance with any suitable compression scheme, e.g., MPEG-1, MPEG-2, MPEG-4, motion JPEG, H.261 or H.263.

The computer system, under the control of suitable application software, first performs event and object extraction 820 on the video data 810, in order to temporally segment the video data 810 into video events and to locate video objects within the events. Video event and object extraction 820 may take the form of a fully automatic processing operation, a semi-automatic processing operation, or a substantially manual operation in which objects are defined primarily through user interaction, such as via a user input device.

In a preferred method, the video event and object extraction process 820 consists of three subsidiary operations, namely temporal video segmentation 825, object extraction 826 and feature extraction and annotation 827. For the

segmentation 825 step, the video is temporally partitioned into shots, continuous groups of shots, or discontinuous groups of shots, that share one or more common characteristics. For the object extraction 826 step, video objects are extracted from the video shots in a similar manner to the extraction of image objects from still images, except that motion and time information may be utilized. The feature extraction and annotation step 827 may be performed in parallel with the object extraction step 826 and operates on the temporally segmented video shots to generate features such as camera motion, key frames and text annotations. The region-based indexing and searching subsystem 210 described above is suitable for automated segmentation, object extraction and feature extraction; the video object segmentation system 230 described above is suitable example of a semi-automated segmentation, object extraction and feature extraction. Manual segmentation and extraction could alternatively be employed.

The event and object extraction processing 820 generates an event and video object set 821 and optional related features such as annotations (collectively "video object descriptions"), which are preferably further processed by an event and object hierarchy extraction and construction module 830. Alternatively, the events and video objects 821 could be directly stored in a database 840, or encoded by an XML encoder 850 or a binary encoder 860 and then stored in database 840.

The module 830 operates on the video object descriptions to generate video object hierarchy descriptions 831. Preferably, the video object descriptions are operated on in parallel by both physical and logical operations. Thus, the video object descriptions may be subjected to both physical (temporal) event hierarchy organization 835 and logical event hierarchy organization 836 in parallel, and then to physical object hierarchy organization 837 and logical object hierarchy organization 838, so that both video events and objects embedded within those events are hierarchally organized. The region-based indexing and searching subsystem 210 described above is suitable for automated video object hierarchy construction; the video object segmentation system 230 described above is suitable

example of a semi-automated video object hierarchy construction. Manual video object hierarchy construction could alternatively be employed.

The video object hierarchy descriptions 831 are either directly stored in a database 840 together with the video object descriptions, or encoded by an XML encoder 850 or a binary encoder 860 and then stored in database 840, as a video description record. Once the video description records have been stored in database storage 840, they remain available in a useful format for access and use by other applications 870, such as search, filter and archiving applications for example, via bidirectional link 871.

The foregoing merely illustrates the principles of the invention. Various modifications and alterations to the described embodiments will be apparent to those skilled in the art in view of applicants' teachings, herein. It will thus be appreciated that those skilled in the art will be able to devise numerous systems and methods which, although not explicitly shown or described herein, embody the principles of the invention and are thus within the spirit and scope of the invention.

Appendix I

image\_ds.dtd:

<!-- Image DS -->

<!ELEMENT image (object\_set, object\_hierarchy\*)>

<!ELEMENT object\_set (object+)>

<!ELEMENT object (location?, text\_annotation?, color?, texture?, shape?, size?, position?, motion?, time?)>

<!ATTLIST object

id ID #REQUIRED

object\_ref IDREF #IMPLIED

object\_node\_ref IDREFS #IMPLIED

type (PHYSICAL|LOGICAL) #REQUIRED>

<!-- External object location DTD -->

<!ENTITY % location SYSTEM "location.dtd">  
%location;

<!-- External object annotation DTD -->

<!ENTITY % text\_annotation SYSTEM "text\_annotation.dtd">  
%text\_annotation;

<!-- External object color DTD -->

<!ENTITY % color SYSTEM "color.dtd">  
%color;

<!-- External object texture DTD -->

<!ENTITY % texture SYSTEM "texture.dtd">  
%texture;

<!-- External object shape DTD -->

<!ENTITY % shape SYSTEM "shape.dtd">  
%shape;

<!-- External object size DTD -->

<!ENTITY % size SYSTEM "size.dtd">  
%size;

<!-- External object position DTD -->

<!ENTITY % position SYSTEM "position.dtd">



%position;

<!-- External object motion DTD -->  
<!ENTITY % motion SYSTEM "motion.dtd">  
%motion;

<!-- External object time DTD -->  
<!ENTITY % time SYSTEM "time.dtd">  
%time;

<!-- Object hierarchy -->  
<!-- The attribute "type" is the hierarchy binding type -->  
<!ELEMENT object\_hierarchy (object\_node)>  
<!ATTLIST object\_hierarchy  
    type (LOGICAL|SPATIAL) #REQUIRED>  
  
<!ELEMENT object\_node (object\_node\*)>  
<!ATTLIST object\_node  
    id ID #REQUIRED  
    object\_ref IDREF #REQUIRED>  
  
<!ENTITY mpeg7 "ISO/IEC JTC1/SC29/WG11 MPEG-7">  
  
<!-- Image DS end -->

location.dtd:

<!-- Description of resources' location-->  
  
<!-- Objects, image, videos can be located/accessed at different locations -->  
<!ELEMENT location (location\_site\*)>  
<!ATTLIST location  
    xml-link CDATA #FIXED "EXTENDED"  
    role CDATA #IMPLIED  
    title CDATA #IMPLIED  
    show (EMBED|REPLACE|NEW) "EMBED"  
    actuate (AUTO|USER) "USER"  
    behavior CDATA #IMPLIED>  
  
<!-- One location site -->  
<!ELEMENT location\_site EMPTY>  
<!ATTLIST location\_site

```
xml-link CDATA #FIXED "LOCATOR"
role CDATA #IMPLIED
href CDATA #REQUIRED
title CDATA #IMPLIED
show (EMBED|REPLACE|NEW) "NEW"
actuate (AUTO|USER) "USER"
behavior CDATA #IMPLIED>
```

```
<!ELEMENT code (location*)>
<!ATTLIST code
  type (EXTRACTION|DISTANCE) "EXTRACTION"
  language (C|JAVA|PERL) #REQUIRED
  version CDATA #REQUIRED>
```

```
<!-- Description of resources' storage location -->
```

text\_annotation.dtd:

```
<!-- Text annotation features -->
```

```
<!ELEMENT text_annotation (concept*, name_annotation?, people_annotation?,
location_annotation?, event_annotation?, date_annotation?, object_annotation?)>
```

```
<!-- Name annotation -->
```

```
<!ELEMENT name_annotation (concept*)>
```

```
<!-- People annotation -->
```

```
<!ELEMENT people_annotation (concept*)>
```

```
<!-- Location annotation -->
```

```
<!ELEMENT location_annotation (concept*)>
```

```
<!-- Event annotation -->
```

```
<!ELEMENT event_annotation (concept*)>
```

```
<!-- Date annotation -->
```

```
<!ELEMENT date_annotation (concept*)>
```

```
<!-- Object annotation -->
```

```
<!ELEMENT object_annotation (concept*)>
```

```
<!-- Concept -->
```

```
<!ELEMENT concept (#PCDATA|code)*>
```

```
<!-- ATTTLIST concept
      language CDATA "english"
      annotation (automatic|manual) "manual">
```

```
<!-- Text annotation features end -->
```

color.dtd:

```
<!-- Color features -->
```

```
<!-- ELEMENT color (color_hist*, luv_color*)>
```

```
<!-- Color histogram feature -->
```

```
<!-- ELEMENT color_hist (color_hist_value, code*)>
```

```
<!-- ATTTLIST color_hist
```

```
      length CDATA #REQUIRED
```

```
      color_space (RGB|OHTA|HSV|LUV) #REQUIRED
```

```
      quantization (uniform|non-uniform) #REQUIRED>
```

```
<!-- ELEMENT color_hist_value (#PCDATA)>
```

```
<!-- ATTTLIST color_hist_value
```

```
      format CDATA #REQUIRED>
```

```
<!-- LUV color feature -->
```

```
<!-- ELEMENT luv_color (luv_color_value, code*)>
```

```
<!-- ATTTLIST luv_color
```

```
      length CDATA #REQUIRED>
```

```
<!-- ELEMENT luv_color_value (luv_bin*)>
```

```
<!-- ELEMENT luv_bin EMPTY>
```

```
<!-- ATTTLIST luv_bin
```

```
      l CDATA #REQUIRED
```

```
      u CDATA #REQUIRED
```

```
      v CDATA #REQUIRED>
```

```
<!-- Color features end -->
```

texture.dtd:

```
<!-- Texture features -->
```

```
<!ELEMENT texture (tamura?)>
```

```
<!-- Tamura texture feature -->
```

```
<!ELEMENT tamura (tamura_value, code*)>
```

```
<!ELEMENT tamura_value EMPTY>
```

```
<!ATTLIST tamura_value
    coarseness CDATA #REQUIRED
    contrast CDATA #REQUIRED
    orientation CDATA #REQUIRED>
```

```
<!-- Texture features end -->
```

shape.dtd:

```
<!-- Shape features -->
```

```
<!ELEMENT shape (eigenvalue_analysis*)>
```

```
<!-- Eigenvalue analysis shape feature -->
```

```
<!ELEMENT eigenvalue_analysis (eigenvalue_analysis_value, code*)>
```

```
<!ATTLIST eigenvalue_analysis
    length CDATA #REQUIRED>
```

```
<!ELEMENT eigenvalue_analysis_value (eigenvalue*)>
```

```
<!ELEMENT eigenvalue EMPTY>
```

```
<!ATTLIST eigenvalue
    value CDATA #REQUIRED>
```

```
<!-- Shape features end -->
```

size.dtd:

```
<!-- Size features -->
```

```
<!-- Size -->
```

```
<!ELEMENT size (size_dimensions | size_num_pixels)>
```

```
<!-- Dimensions (X,Y) -->
```

```
<!ELEMENT size_dimensions EMPTY>
```

```
<!ATTLIST size_dimensions
```

```
x CDATA #REQUIRED
y CDATA #REQUIRED>
```

```
<!-- Number of pixels -->
<!ELEMENT size_num_pixels EMPTY>
<!ATTLIST size_num_pixels
    area CDATA #REQUIRED>
```

```
<!-- Size features end -->
```

position.dtd:

```
<!-- Position features -->
```

```
<!ELEMENT position (segmentation_mask_analysis*)>
```

```
<!-- Segmentation mask position feature -->
<!ELEMENT segmentation_mask_analysis (segmentation_mask_analysis_value,
code*)>
```

```
<!ELEMENT segmentation_mask_analysis_value (left-top_vertex, centroid)>
```

```
<!ELEMENT left-top_vertex EMPTY>
<!ATTLIST left-top_vertex
    x CDATA #REQUIRED
    y CDATA #REQUIRED>
```

```
<!ELEMENT centroid EMPTY>
<!ATTLIST centroid
    x CDATA #REQUIRED
    y CDATA #REQUIRED>
```

```
<!-- Position features end -->
```

motion.dtd:

```
<!-- Motion features -->
```

```
<!ELEMENT motion (affine_model*)>
```

```
<!-- Affine motion feature -->
<!ELEMENT affine_model (affine_model_value, code*)>
```

```
<!ELEMENT affine_model_value (vector2d*)>
```

```
<!ELEMENT vector2d EMPTY>
```

```
<!ATTLIST vector2d
    x CDATA #REQUIRED
    y CDATA #REQUIRED>
```

```
<!-- Motion features end -->
```

time.dtd:

```
<!-- Time duration features -->
```

```
<!ELEMENT time (time_interval*|time_instant|time_span)>
```

```
<!-- Continuos duration time (seconds or frames in video clip)-->
```

```
<!ELEMENT time_interval EMPTY >
```

```
<!ATTLIST time_interval
    unit (SECONDS|FRAMES) "SECONDS"
    start CDATA #REQUIRED
    end CDATA #REQUIRED>
```

```
<!-- Instant in time -->
```

```
<!ELEMENT time_instant EMPTY>
```

```
<!ATTLIST time_instant
    unit (SECONDS|FRAMES) "SECONDS"
    instant CDATA #REQUIRED>
```

```
<!-- Continuos duration time -->
```

```
<!ELEMENT time_span EMPTY >
```

```
<!ATTLIST time_span
    unit (SECONDS|FRAMES) "SECONDS"
    span CDATA #REQUIRED>
```

```
<!-- Time duration features end -->
```

Family\_Portrait.xml:

```
<?xml version="1.0" standalone="no"?>
```

```
<!DOCTYPE image PUBLIC "ISO//mpeg7//xml//dtd//image_ds"
"http://www.ee.columbia.edu/mpeg7/xml/dtd/image_ds.dtd">
```

```
<image>
<object_set>
<!-- Family portrait -->
<object id="0" type="PHYSICAL" object_node_ref="9">
<location>
<location_site href="http://www.family.portrait.gif"/>
</location>
<text_annotation>
<name_annotation>
<concept>Family Portrait</concept>
</name_annotation>
<date_annotation>
<concept>September 26th, 1998</concept>
</date_annotation>
</text_annotation>

<color>
<luv_color length="1">
<luv_color_value>
<luv_bin l="56.70" u="4.67" v="78.56"/>
</luv_color_value>
</luv_color>
</color>
</object>

<!-- Father -->
<object id="1" type="PHYSICAL" object_node_ref="11">
<text_annotation>
<people_annotation>
<concept>Father</concept>
</people_annotation>
</text_annotation>
...
</object>

<!-- Mother -->
<object id="2" type="PHYSICAL" object_node_ref="13">
<text_annotation>
<people_annotation>
<concept>Mother</concept>
</people_annotation>
</text_annotation>
...
</object>
```

```
<!-- Son -->
<object id="3" type="PHYSICAL" object_node_ref="16">
  <text_annotation>
    <people_annotation>
      <concept>Son</concept>
    </people_annotation>
  </text_annotation>
  ...
</object>

<!-- Parents -->
<object id="4" type="PHYSICAL" object_node_ref="10">
  <text_annotation>
    <people_annotation>
      <concept>Parents</concept>
    </people_annotation>
  </text_annotation>
  ...
</object>

<!-- Children -->
<object id="5" type="PHYSICAL" object_node_ref="15">
  <text_annotation>
    <people_annotation>
      <concept>Children</concept>
    </people_annotation>
  </text_annotation>
  ...
</object>

<!-- Faces -->
<object id="6" type="LOGICAL" object_node_ref="17">
  <text_annotation>
    <people_annotation>
      <concept>Faces</concept>
    </people_annotation>
  </text_annotation>
  ...
</object>

<!-- Father's face-->
<object id="7" type="PHYSICAL" object_node_ref="12 18">
  <text_annotation>
    <people_annotation>
```



```
<concept>Father's face</concept>
</people_annotation>
</text_annotation>
...
</object>

<!-- Mother's face -->
<object id="8" type="PHYSICAL" object_node_ref="14 19">
<text_annotation>
<people_annotation>
<concept>Mother's face</concept>
</people_annotation>
</text_annotation>
...
</object>
</object_set>

<object_hierarchy type="PHYSICAL">
<!-- Family portrait -->
<object_node id="9" object_ref="0">
<!-- Parents -->
<object_node id="10" object_ref="4">
<object_node id="11" object_ref="1">
<object_node id="12" object_ref="7"/>
</object_node>
<object_node id="13" object_ref="2">
<object_node id="14" object_ref="8"/>
</object_node>
</object_node>
<!-- Children -->
<object_node id="15" object_ref="5">
<object_node id="16" object_ref="3"/>
</object_node>
</object_node>
</object_hierarchy>

<object_hierarchy type="LOGICAL">
<!-- Faces -->
<object_node id="17" object_ref="6">
<object_node id="18" object_ref="7"/>
<object_node id="19" object_ref="8"/>
</object_node>
</object_node>
</object_hierarchy>
```

</image>

## Appendix II

?xml version="1.0" standalone="no"?>

<!DOCTYPE image PUBLIC "ISO//mpeg7//xml//dtd//image\_ds" "image\_ds.dtd">

<image>

<object\_set>

<object id="o0" type="PHYSICAL">

<location>

<location\_site

href="http://www.ee.columbia.edu/~syp/images/yosemite.gif"/>

</location>

<text\_annotation>

<name\_annotation>

<concept>Yosemite's Nevada

Falls</concept>

<concept language="spanish">Cataratas del

Nevada en Yosemite</concept>

</name\_annotation>

<people\_annotation>

<concept>Seungyup Paek</concept>

<concept>Alex Jaimes</concept>

</people\_annotation>

<location\_annotation>

<concept>Yosemite's Nevada

Falls</concept>

<concept

annotation="automatic">outdoor</concept>

<concept

annotation="automatic">landscape</concept>

</location\_annotation>

<event\_annotation>

<concept>Trip to Nevada Falls in

Yosemite</concept>

</event\_annotation>

<date\_annotation>

<concept>September 26th, 1998</concept>

</date\_annotation>

</text\_annotation>

```
<color>
  <luv_color length="1">
    <luv_color_value>
      <luv_bin l="56.70" u="4.67"
v="78.56"/>
    </luv_color_value>
  </luv_color>
</color>

<texture>
  <tamura>
    <tamura_value coarseness="0.70"
contrast="0.67" orientation="0.22"/>
  </tamura>
</texture>

<size>
  <size_dimensions x="512" y="734"/>
</size>
</object>

<object id="o1" type="PHYSICAL">
  <text_annotation>
    <name_annotation>
      <concept>Seungyup Paek</concept>
    </name_annotation>
    <people_annotation>
      <concept>Seungyup Paek</concept>
    </people_annotation>
  </text_annotation>

  <color>
    <luv_color length="1">
      <luv_color_value>
        <luv_bin l="56.70" u="4.67"
v="78.56"/>
      </luv_color_value>
    </luv_color>
  </color>

  <texture>
    <tamura>
      <tamura_value coarseness="0.70"
contrast="0.67" orientation="0.22"/>
    </tamura>
  </texture>
</object>
```

```
        </tamura>
    </texture>

    <shape>
        <eigenvalue_analysis length="2">
            <eigenvalue_analysis_value>
                <eigenvalue value="1.22"/>
                <eigenvalue value="0.22"/>
            </eigenvalue_analysis_value>
        </eigenvalue_analysis>
    </shape>

    <size>
        <size_num_pixels area="734"/>
    </size>

    <position>
        <segmentation_mask_analysis>
            <segmentation_mask_analysis_value>
                <left-top_vertex x="23" y="45"/>
                <centroid x="35" y="57"/>
            </segmentation_mask_analysis_value>
        </segmentation_mask_analysis>
    </position>
</object>

<object id="o2" type="PHYSICAL">
    <text_annotation>
        <concept>Seungyup's face</concept>
    </text_annotation>
    <!-- Other tags -->
</object>

<object id="o3" type="LOGICAL">
    <text_annotation>
        <concept>Faces</concept>
    </text_annotation>
</object>
</object_set>

<object_hierarchy type="PHYSICAL">
    <object_node id="o4" object_ref="o0">
        <object_node id="o5" object_ref="o1">
            <object_node id="o6" object_ref="o2"/>
        </object_node>
    </object_node>
</object_hierarchy>
```

```
        </object_node>
      </object_node>
    </object_hierarchy>

    <object_hierarchy type="LOGICAL">
      <object_node id="o7" object_ref="o3">
        <object_node id="o8" object_ref="o2"/>
      </object_node>
    </object_hierarchy>
  </image>
```

Appendix III

video\_ds.dtd:

<!-- Video DS -->

<!ELEMENT video (event\_set, event\_hierarchy\*)>

<!ELEMENT event\_set (event+)>

<!ELEMENT event (location?, transition?, text\_annotation?, object\_set?,  
camera\_motion?, time?, key\_frame\*)>

<!ATTLIST event

id ID #REQUIRED

event\_ref IDREF #IMPLIED

event\_node\_ref IDREFS #IMPLIED

type

(SHOT|CONTINUOUS\_GROUP\_SHOTS|DISCONTINUOUS\_GROUP\_SHOTS)  
#REQUIRED>

<!-- External image DS DTD -->

<!ENTITY % image\_ds SYSTEM "image\_ds.dtd">

%image\_ds;

<!-- Example of transitions:

- dissolve (additive, cross, non-additive),
- slide (band, slash, normal, band, boxes),
- wipe (radial, random, rectangular, moving, crossed, star-shaped, corner,  
soft, cross-shaped, band, soft, gradient, diamond-shaped, pointed, circular, shaped),
- merge (center),
- peel (center, page, back),
- stretch (cross, image, in, over),
- spin (cube, rectangular, image, away),
- zoom, curtain, door, funnel, spiral boxes, paint splatter, motion,  
luminance, push, flip, fold up, etc.

-->

<!ELEMENT transition EMPTY>

<!ATTLIST transition

effect CDATA #REQUIRED>

<!-- External camera motion descriptor DTD -->

<!ENTITY % camera\_motion SYSTEM "camera\_motion.dtd">

%camera\_motion;

<!ELEMENT key\_frame (size\_dimensions?, time\_instant?)>

<!-- Event hierarchy -->

<!-- The attribute "type" is the hierarchy binding type -->

<!ELEMENT event\_hierarchy (event\_node)>

<!ATTLIST event\_hierarchy  
type (LOGICAL|SPATIAL) #REQUIRED>

<!ELEMENT event\_node (event\_node\*, object\_hierarchy\*)>

<!ATTLIST event\_node  
id ID #REQUIRED  
event\_ref IDREF #REQUIRED>

<!-- Video DS end -->

camera\_motion.dtd:

<!-- Camera motion features -->

<!ELEMENT camera\_motion (background\_affine\_motion\*)>

<!-- Affine model for camera motion detection -->

<!ELEMENT background\_affine\_motion (background\_affine\_motion\_value,  
code\*)>

<!ELEMENT background\_affine\_motion\_value (panning?, zoom?)>

<!ELEMENT panning EMPTY>

<!ATTLIST panning  
direction (NT|NE|ET|SE|ST|SW|WT|NW) #REQUIRED>

<!ELEMENT zoom EMPTY>

<!ATTLIST zoom  
direction (IN|OUT) #REQUIRED>

<!-- Camera motion features end -->

Appendix IV

```

<?xml version="1.0" standalone="no"?>
<!DOCTYPE video PUBLIC "ISO//mpeg7//xml//dtd//video_ds" "video_ds.dtd">

<video>

  <event_set>
    <event id="e0" type="CONTINUOUS_GROUP_SHOTS">
      <location>
        <location_site href="yosemite.avi"/>
      </location>

      <text_annotation>
        <name_annotation>
          <concept>Yosemite's Nevada
Falls</concept>
          <concept language="spanish">Cataratas del
Nevada en Yosemite</concept>
        </name_annotation>
        <people_annotation>
          <concept>Seungyup Paek</concept>
        </people_annotation>
        <location_annotation>
          <concept>Yosemite's Nevada
Falls</concept>
        <concept
annotation="automatic">outdoor</concept>
        <concept
annotation="automatic">landscape</concept>
      </location_annotation>
      <event_annotation>
        <concept>Trip to Nevada Falls</concept>
      </event_annotation>
      <date_annotation>
        <concept>September 26th, 1998</concept>
      </date_annotation>
    </text_annotation>

    <object_set>
      <object id="o0" type="PHYSICAL">
        <text_annotation>
          <name_annotation>

```



```

Paek</concept>
Paek</concept>
u="4.67" v="78.56"/>
coarseness="0.70" contrast="0.67" orientation="0.22"/>
value="1.22"/>
value="0.22"/>
<segmentation_mask_analysis_value>
x="23" y="45"/>
y="57"/>
<concept>Seungyup
</name_annotation>
<people_annotation>
<concept>Seungyup
</people_annotation>
</text_annotation>
<color>
<luv_color length="1">
<luv_color_value>
<luv_bin l="56.70"
</luv_color_value>
</luv_color>
</color>
<texture>
<tamura>
<tamura_value
coarseness="0.70" contrast="0.67" orientation="0.22"/>
</tamura>
</texture>
<shape>
<eigenvalue_analysis length="2">
<eigenvalue_analysis_value>
<eigenvalue
<eigenvalue
</eigenvalue_analysis_value>
</eigenvalue_analysis>
</shape>
<size>
<size_num_pixels area="734"/>
</size>
<position>
<segmentation_mask_analysis>
<segmentation_mask_analysis_value>
<left-top_vertex
<centroid x="35"

```

```

</segmentation_mask_analysis_value>
                                </segmentation_mask_analysis >
                                </position>
                                <motion>
                                    <affine_model>
                                        <affine_model_value>
                                            <vector2d x="12.3"
y="2.34"/>
                                            <vector2d x="1.3"
y="12.34"/>
                                            <vector2d x="0.3"
y="23.34"/>
                                        </affine_model_value>
                                    </affine_model>
                                </motion>
                                <time>
                                    <time_interval unit="FRAMES"
start="1" end="3"/>
                                </time>
                                </object>
                                <object id="o1" type="PHYSICAL">
                                    <text_annotation>
                                        <concept>Seungyup's face</concept>
                                    </text_annotation>
                                    <!-- Other tags -->
                                </object>
                                <object id="o2" type="LOGICAL">
                                    <text_annotation>
                                        <concept>Faces</concept>
                                    </text_annotation>
                                </object>
                                </object_set>

                                <camera_motion>
                                    <background_affine_motion>
                                        <background_affine_motion_value>
                                            <panning direction="SE"/>
                                            <zoom direction="IN"/>
                                        </background_affine_motion_value>
                                    </background_affine_motion>
                                </camera_motion>

                                <time>

```

```
end="10"/>
    <time_interval unit="FRAMES" start="1"
    </time>
    <key_frame>
        <size_dimensions x="512" y="734"/>
        <time_instant unit="FRAMES" instant="5"/>
    </key_frame>
</event>
</event_set>
<event_hierarchy type="PHYSICAL">
    <event_node id="e1" event_ref="e0">
        <object_hierarchy type="SPATIAL">
            <object_node id="o3" object_ref="o0">
                <object_node id="o4" object_ref="o1"/>
            </object_node>
        </object_hierarchy>
        <object_hierarchy type="LOGICAL">
            <object_node id="o5" object_ref="o3">
                <object_node id="o6" object_ref="o1"/>
            </object_node>
        </object_hierarchy>
    </event_node>
</event_hierarchy>
</video>
```

Claims

We claim:

- 1 1. A system for generating a description record from multimedia information,  
2 comprising:
  - 3 (a) at least one multimedia information input interface receiving said  
4 multimedia information;
  - 5 (b) a computer processor, coupled to said at least one multimedia  
6 information input interface, receiving said multimedia information  
7 therefrom, processing said multimedia information by performing  
8 object extraction processing to generate multimedia object  
9 descriptions from said multimedia information, and processing said  
10 generated multimedia object descriptions by object hierarchy  
11 processing to generate multimedia object hierarchy descriptions,  
12 wherein at least one description record including said multimedia  
13 object descriptions and said multimedia object hierarchy  
14 descriptions is generated for content embedded within said  
15 multimedia information; and
  - 16 (c) a data storage system, operatively coupled to said processor, for  
17 storing said at least one description record.
- 1 2. The system of claim 1, wherein said multimedia information comprises  
2 image information, said multimedia object descriptions comprise image object  
3 descriptions, and said multimedia object hierarchy descriptions comprise image  
4 object hierarchy descriptions.
- 1 3. The system of claim 2, wherein said object extraction processing comprises:
  - 2 (a) image segmentation processing to segment each image in said  
3 image information into regions within said image; and

4 (b) feature extraction processing to generate one or more feature  
5 descriptions for one or more of said regions;  
6 whereby said generated object descriptions comprise said one or more feature  
7 descriptions for one or more of said regions.

1 4. The system of claim 3, wherein said one or more feature descriptions are  
2 selected from the group consisting of text annotations, color, texture, shape, size,  
3 and position.

1 5. The system of claim 2, wherein said object hierarchy processing comprises  
2 physical object hierarchy organization to generate physical object hierarchy  
3 descriptions of said image object descriptions that are based on spatial  
4 characteristics of said objects, such that said image object hierarchy descriptions  
5 comprise physical descriptions.

1 6. The system of claim 5, wherein said object hierarchy processing further  
2 comprises logical object hierarchy organization to generate logical object hierarchy  
3 descriptions of said image object descriptions that are based on semantic  
4 characteristics of said objects, such that said image object hierarchy descriptions  
5 comprise both physical and logical descriptions.

1 7. The system of claim 6, wherein said object extraction processing comprises:  
2 (a) image segmentation processing to segment each image in said  
3 image information into regions within said image; and  
4 (b) feature extraction processing to generate object descriptions for one  
5 or more of said region;  
6 and wherein said physical hierarchy organization and said logical hierarchy  
7 organization generate hierarchy descriptions of said object descriptions for said  
8 one or more of said regions.

1     8.     The system of claim 7, further comprising an encoder receiving said image  
2     object hierarchy descriptions and said image object descriptions, and encoding said  
3     image object hierarchy descriptions and said image object descriptions into  
4     encoded description information, wherein said data storage system is operative to  
5     store said encoded description information as said at least one description record.

1     9.     The system of claim 1, wherein said multimedia information comprises  
2     video information, said multimedia object descriptions comprise video object  
3     descriptions including both event descriptions and object descriptions, and said  
4     multimedia hierarchy descriptions comprise video object hierarchy descriptions  
5     including both event hierarchy descriptions and object hierarchy descriptions.

1     10.    The system of claim 9, wherein said object extraction processing comprises:  
2         (a)    temporal video segmentation processing to temporally segment said  
3                video information into one or more video events or groups of video  
4                events and generate event descriptions for said video events,  
5         (b)    video object extraction processing to segment said one or more  
6                video events or groups of video events into one or more regions,  
7                and to generate object descriptions for said regions; and  
8         (c)    feature extraction processing to generate one or more event feature  
9                descriptions for said one or more video events or groups of video  
10              events, and one or more object feature descriptions for said one or  
11              more regions;  
12    wherein said generated video object descriptions include said event feature  
13    descriptions and said object descriptions.

1     11.    The system of claim 10, wherein said one or more event feature  
2     descriptions are selected from the group consisting of text annotations, shot  
3     transition, camera motion, time and key frame, and wherein said one or more

4 object feature descriptions are selected from the group consisting of color, texture,  
5 shape, size, position, motion, and time.

6 12. The system of claim 9, wherein said object hierarchy processing comprises  
7 physical event hierarchy organization to generate physical event hierarchy  
8 descriptions of said video object descriptions that are based on temporal  
9 characteristics of said video objects, such that said video hierarchy descriptions  
10 comprise temporal descriptions.

1 13. The system of claim 12, wherein said object hierarchy processing further  
2 comprises logical event hierarchy organization to generate logical event hierarchy  
3 descriptions of said video object descriptions that are based on semantic  
4 characteristics of said video objects, such that said hierarchy descriptions comprise  
5 both temporal and logical descriptions.

1 14. The system of claim 13, wherein said object hierarchy processing further  
2 comprises physical and logical object hierarchy extraction processing, receiving  
3 said temporal and logical descriptions and generating object hierarchy descriptions  
4 for video objects embedded within said video information, such that said video  
5 hierarchy descriptions comprise temporal and logical event and object descriptions.

1 15. The system of claim 14, wherein said object extraction processing  
2 comprises:

- 3 (a) temporal video segmentation processing to temporally segment said  
4 video information into one or more video events or groups of video  
5 events and generate event descriptions for said video events,
- 6 (b) video object extraction processing to segment said one or more  
7 video events or groups of video events into one or more regions,  
8 and to generate object descriptions for said regions; and

9 (c) feature extraction processing to generate one or more event feature  
10 descriptions for said one or more video events or groups of video  
11 events, and one or more object feature descriptions for said one or  
12 more regions;  
13 wherein said generated video object descriptions include said event feature  
14 descriptions and said object descriptions, and wherein said physical event hierarchy  
15 organization and said logical event hierarchy organization generate hierarchy  
16 descriptions from said event feature descriptions, and wherein said physical object  
17 hierarchy organization and said logical object hierarchy organization generate  
18 hierarchy descriptions from said object feature descriptions

1 16. The system of claim 15, further comprising an encoder receiving said video  
2 object hierarchy descriptions and said video object descriptions, and encoding said  
3 said video object hierarchy descriptions and said video object descriptions into  
4 encoded description information, wherein said data storage system is operative to  
5 store said encoded description information as said at least one description record.

1 17. A method for generating a description record from multimedia information,  
2 comprising the steps of:

- 3 (a) receiving said multimedia information;  
4 (b) processing said multimedia information by performing object  
5 extraction processing to generate multimedia object descriptions  
6 from said multimedia information;  
7 (c) processing said generated multimedia object descriptions by object  
8 hierarchy processing to generate multimedia object hierarchy  
9 descriptions, wherein at least one description record including said  
10 multimedia object descriptions and said multimedia object hierarchy  
11 descriptions is generated for content embedded within said  
12 multimedia information; and  
13 (d) storing said at least one description record.



1 18. The method of claim 17, wherein said multimedia information comprises  
2 image information, said multimedia object descriptions comprise image object  
3 descriptions, and said multimedia object hierarchy descriptions comprise image  
4 object hierarchy descriptions.

1 19. The method of claim 2, wherein said object extraction processing step  
2 comprises the sub-steps of:

3 (a) image segmentation processing to segment each image in said  
4 image information into regions within said image; and

5 (b) feature extraction processing to generate one or more feature  
6 descriptions for one or more of said regions;

7 whereby said generated image object descriptions comprise said one or more  
8 feature descriptions for one or more of said regions.

1 20. The method of claim 19, wherein said one or more feature descriptions are  
2 selected from the group consisting of text annotations, color, texture, shape, size,  
3 and position.

1 21. The method of claim 18, wherein said step of object hierarchy processing  
2 includes the sub-step of physical object hierarchy organization to generate physical  
3 object hierarchy descriptions of said image object descriptions that are based on  
4 spatial characteristics of said objects, such that said image hierarchy descriptions  
5 comprise physical descriptions.

1 22. The method of claim 21, said step of object hierarchy processing further  
2 includes the sub-step of logical object hierarchy organization to generate logical  
3 object hierarchy descriptions of said image object descriptions that are based on  
4 semantic characteristics of said objects, such that said image object hierarchy  
descriptions comprise both physical and logical descriptions.

1 23. The method of claim 22, wherein said step of object extraction processing  
2 further includes the sub-steps of:

- 3 (a) image segmentation processing to segment each image in said  
4 image information into regions within said image; and  
5 (b) feature extraction processing to generate object descriptions for one  
6 or more of said region;

7 and wherein said physical object hierarchy organization sub-step and said logical  
8 object hierarchy organization sub-step generate hierarchy descriptions of said  
9 object descriptions for said one or more of said regions.

1 24. The method of claim 24, further comprising the step of encoding said  
2 image object descriptions and said image object hierarchy descriptions into  
3 encoded description information prior to said data storage step.

1 25. The method of claim 17, wherein said multimedia information comprises  
2 video information, said multimedia object descriptions comprise video object  
3 descriptions including both event descriptions and object descriptions, and said  
4 multimedia hierarchy descriptions comprise video object hierarchy descriptions  
5 including both event hierarchy descriptions and object hierarchy descriptions.

1 26. The method of claim 25, wherein said step of object extraction processing  
2 comprises the sub-steps of:

- 3 (a) temporal video segmentation processing to temporally segment said  
4 video information into one or more video events or groups of video  
5 events and generate event descriptions for said video events,  
6 (b) video object extraction processing to segment said one or more  
7 video events or groups of video events into one or more regions,  
8 and to generate object descriptions for said regions; and

9           (c)     feature extraction processing to generate one or more event feature  
10                 descriptions for said one or more video events or groups of video  
11                 events, and one or more object feature descriptions for said one or  
12                 more regions;  
13     wherein said generated video object descriptions include said event feature  
14     descriptions and said object descriptions.

1     27.     The method of claim 26, wherein said one or more event feature  
2     descriptions are selected from the group consisting of text annotations, shot  
3     transition, camera motion, time and key frame, and wherein said one or more  
4     object feature descriptions are selected from the group consisting of color, texture,  
5     shape, size, position, motion, and time.

6     28.     The method of claim 25, wherein said step of object hierarchy processing  
7     includes the sub-step of physical event hierarchy organization to generate physical  
8     event hierarchy descriptions of said video object descriptions that are based on  
9     temporal characteristics of said video objects, such that said video hierarchy  
10    descriptions comprise temporal descriptions.

1     29.     The method of claim 28, wherein said step of object hierarchy processing  
2     further includes the sub-step of logical event hierarchy organization to generate  
3     logical event hierarchy descriptions of said video object descriptions that are based  
4     on semantic characteristics of said video objects, such that said hierarchy  
5     descriptions comprise both temporal and logical descriptions.

1     30.     The method of claim 29, wherein said step of object hierarchy processing  
2     further comprises the sub-step physical and logical object hierarchy extraction  
3     processing, receiving said temporal and logical descriptions and generating object  
4     hierarchy descriptions for video objects embedded within said video information,

5 such that said video hierarchy descriptions comprise temporal and logical event and  
6 object descriptions..

1 31. The method of claim 30, wherein said step of object extraction processing  
2 comprises the sub-steps of:

- 3 (a) temporal video segmentation processing to temporally segment said  
4 video information into one or more video events or groups of video  
5 events and generate event descriptions for said video events,  
6 (b) video object extraction processing to segment said one or more  
7 video events or groups of video events into one or more regions,  
8 and to generate object descriptions for said regions; and  
9 (c) feature extraction processing to generate one or more event feature  
10 descriptions for said one or more video events or groups of video  
11 events, and one or more object feature descriptions for said one or  
12 more regions;

13 wherein said generated video object descriptions include said event feature  
14 descriptions and said object descriptions, and wherein said physical event hierarchy  
15 organization and said logical event hierarchy organization generate hierarchy  
16 descriptions from said event feature descriptions, and wherein said physical object  
17 hierarchy organization and said logical object hierarchy organization generate  
18 hierarchy descriptions from said object feature descriptions.

1 32. The method of claim 15, further comprising the step of encoding said video  
2 object descriptions and said video object hierarchy descriptions into encoded  
3 description information prior to said data storage step.

1 33. A computer readable media containing digital information with at least one  
2 multimedia description record describing multimedia content for corresponding  
3 multimedia information, the description record comprising:

- 4           (a)     one or more multimedia object descriptions describing  
5                    corresponding multimedia objects;  
6           (b)     one or more features characterizing each of said multimedia object  
7                    descriptions; and  
8           (c)     one or more multimedia object hierarchy descriptions, if any,  
9                    relating at least a portion of said one or more multimedia objects in  
10                  accordance with one or more characteristics.

1     34.     The computer readable media of claim 33, wherein said multimedia  
2     information comprises image information, said multimedia objects comprise image  
3     objects, said multimedia object descriptions comprise image object descriptions,  
4     and said multimedia object hierarchy descriptions comprise image object hierarchy  
5     descriptions.

1     35.     The computer readable media of claim 34, wherein said one or more  
2     features are selected from the group consisting of text annotations, color, texture,  
3     shape, size, and position.

1     36.     The computer readable media of claim 34, wherein said image object  
2     hierarchy descriptions comprise physical object hierarchy descriptions of said  
3     image object descriptions based on spatial characteristics of said image objects.

1     37.     The computer readable media of claim 36, wherein said image object  
2     hierarchy descriptions further comprises logical object hierarchy descriptions of  
3     said image object descriptions based on semantic characteristics of said image  
4     objects.

1     38.     The computer readable media of claim 33, wherein said multimedia  
2     information comprises video information, said multimedia objects comprise events  
3     and video objects, said multimedia object descriptions comprise video object

4 descriptions including both event descriptions and object descriptions, said features  
5 comprise video event features and video object features, and said multimedia  
6 hierarchy descriptions comprise video object hierarchy descriptions including both  
7 event hierarchy descriptions and object hierarchy descriptions.

1 39. The computer readable media of claim 38, wherein said one or more event  
2 feature descriptions are selected from the group consisting of text annotations, shot  
3 transition, camera motion, time and key frame, and wherein said one or more  
4 object feature descriptions are selected from the group consisting of color, texture,  
5 shape, size, position, motion, and time..

1 40. The computer readable media of claim 38, wherein said event hierarchy  
2 descriptions comprise one or more physical hierarchy descriptions of said events  
3 based on temporal characteristics.

1 41. The computer readable media of claim 40, wherein said event hierarchy  
2 descriptions further comprise one or more logical hierarchy descriptions. of said  
3 events based on semantic characteristics.

1 42. The computer readable media of claim 38, wherein said object hierarchy  
2 descriptions comprise one or more physical hierarchy descriptions of said objects  
3 based on temporal characteristics.

1 43. The computer readable media of claim 39, wherein said object hierarchy  
2 descriptions further comprise one or more logical hierarchy descriptions. of said  
3 objects based on semantic characteristics.

**AMENDED CLAIMS**

[received by the International Bureau on 12 May 2000 (12.05.00);  
original claims 1, 17 and 33 amended; remaining claims unchanged (3 pages)]

- 1 1. A system for generating a description record from multimedia information,  
2 comprising:
- 3 (a) at least one multimedia information input interface receiving said  
4 multimedia information;
- 5 (b) a computer processor, coupled to said at least one multimedia  
6 information input interface, receiving said multimedia information  
7 therefrom, processing said multimedia information by performing  
8 object extraction processing to generate multimedia object  
9 descriptions from said multimedia information, and processing said  
10 generated multimedia object descriptions by object hierarchy  
11 processing to generate multimedia object hierarchy descriptions  
12 indicative of an organization of said object descriptions, wherein at  
13 least one description record including said multimedia object  
14 descriptions and said multimedia object hierarchy descriptions is  
15 generated for content embedded within said multimedia  
16 information; and
- 17 (c) a data storage system, operatively coupled to said processor, for  
18 storing said at least one description record.

- 1 2. The system of claim 1, wherein said multimedia information comprises  
2 image information, said multimedia object descriptions comprise image object  
3 descriptions, and said multimedia object hierarchy descriptions comprise image  
4 object hierarchy descriptions.

- 1 3. The system of claim 2, wherein said object extraction processing comprises:  
2 (a) image segmentation processing to segment each image in said  
3 image information into regions within said image; and

**AMENDED SHEET (ARTICLE 19)**

9 (c) feature extraction processing to generate one or more event feature  
10 descriptions for said one or more video events or groups of video  
11 events, and one or more object feature descriptions for said one or  
12 more regions;  
13 wherein said generated video object descriptions include said event feature  
14 descriptions and said object descriptions, and wherein said physical event hierarchy  
15 organization and said logical event hierarchy organization generate hierarchy  
16 descriptions from said event feature descriptions, and wherein said physical object  
17 hierarchy organization and said logical object hierarchy organization generate  
18 hierarchy descriptions from said object feature descriptions

1 16. The system of claim 15, further comprising an encoder receiving said video  
2 object hierarchy descriptions and said video object descriptions, and encoding said  
3 said video object hierarchy descriptions and said video object descriptions into  
4 encoded description information, wherein said data storage system is operative to  
5 store said encoded description information as said at least one description record.

1 17. A method for generating a description record from multimedia information,  
2 comprising the steps of:

- 3 (a) receiving said multimedia information;  
4 (b) processing said multimedia information by performing object  
5 extraction processing to generate multimedia object descriptions  
6 from said multimedia information;  
7 (c) processing said generated multimedia object descriptions by object  
8 hierarchy processing to generate multimedia object hierarchy  
9 descriptions indicative of an organization of said object  
10 descriptions, wherein at least one description record including said  
11 multimedia object descriptions and said multimedia object hierarchy  
12 descriptions is generated for content embedded within said  
13 multimedia information; and  
14 (d) storing said at least one description record.

AMENDED SHEET (ARTICLE 19)



- 4 (a) one or more multimedia object descriptions describing  
5 corresponding multimedia objects;  
6 (b) one or more features characterizing each of said multimedia object  
7 descriptions; and  
8 (c) one or more multimedia object hierarchy descriptions indicative of  
9 an organization of said object descriptions, if any, relating at least a  
10 portion of said one or more multimedia objects in accordance with  
11 one or more characteristics.

1 34. The computer readable media of claim 33, wherein said multimedia  
2 information comprises image information, said multimedia objects comprise image  
3 objects, said multimedia object descriptions comprise image object descriptions,  
4 and said multimedia object hierarchy descriptions comprise image object hierarchy  
5 descriptions.

1 35. The computer readable media of claim 34, wherein said one or more  
2 features are selected from the group consisting of text annotations, color, texture,  
3 shape, size, and position.

1 36. The computer readable media of claim 34, wherein said image object  
2 hierarchy descriptions comprise physical object hierarchy descriptions of said  
3 image object descriptions based on spatial characteristics of said image objects.

1 37. The computer readable media of claim 36, wherein said image object  
2 hierarchy descriptions further comprises logical object hierarchy descriptions of  
3 said image object descriptions based on semantic characteristics of said image  
4 objects.

1 38. The computer readable media of claim 33, wherein said multimedia  
2 information comprises video information, said multimedia objects comprise events  
3 and video objects, said multimedia object descriptions comprise video object

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**TRANSMITTAL LETT. TO THE  
UNITED STATES RECEIVING OFFICE**

Date	17 May 2000
International Application	PCT/US99/26125
Attorney Docket No.	32095-PCT

**I. Certification under 37 CFR 1.10 (if applicable)**

EJ339574215US
Express Mail mailing number

17 May 2000
Date of Deposit

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.


Signature of person mailing correspondence

Leroy Chick
Typed or printed name of person mailing correspondence

**II. ☐ New International Application**

TITLE		Earliest priority date (Day/Month/Year)

**SCREENING DISCLOSURE INFORMATION:** In order to assist in screening the accompanying international application for purposes of determining whether a license for foreign transmittal should and could be granted and for other purposes, the following information is supplied. (Note: check as many boxes as apply):

- A. ☐ The invention disclosed was **not** made in the United States.
- B. ☐ There is no prior U.S. application relating to this invention.
- C. ☐ The following prior U.S. application(s) contain subject matter which is related to the invention disclosed in the attached international application. (NOTE: priority to these applications may or may not be claimed on form PCT/RO/101 (Request) and this listing does not constitute a claim for priority).

application no.		filed on	
application no.		filed on	

- D. ☐ The present international application ☐ is identical ☐ contains less subject matter than that found in the prior U.S. application(s) identified in paragraph C.
- E. ☐ The present international application ☐ contains additional subject matter not found in the prior U.S. application(s) identified in paragraph C. above. The additional subject matter is found on pages  and ☐ DOES NOT ALTER ☐ MIGHT BE CONSIDERED TO ALTER the general nature of the invention in a manner which would require the U.S. application to have been made available for inspection by the appropriate defense agencies under 35 U.S.C. 181 and 37 CFR 5.1. See 37 CFR 5.15

**III. ☐ A Response to an Invitation from the RO/US. The following document(s) is (are) enclosed:**

- A. ☐ A Request for An Extension of Time to File a Response
- B. ☐ A Power of Attorney (General or Regular)
- C. ☐ Replacement pages:

pages		of the request (PCT/RO/101)	pages		of the figures
pages		of the description	pages		of the abstract
pages		of the claims			

- D. ☐ Submission of Priority Documents

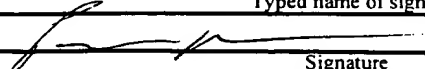
Priority document		Priority document	
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- E. ☐ Fees as specified on attached Fee Calculation sheet form PCT/RO/101 annex

**IV. ☐ A Request for Rectification under PCT 91 ☐ A Petition ☐ A Sequence Listing Diskette**

- V. ☒ Other (please specify): Demand for International Preliminary Examination (4 sheets), Fee Calculation Sheet, Amendment Under Article 19, a postcard, and a check in the amount of \$903.

The person  
signing this  
form is the:

<input type="checkbox"/> Applicant	Paul A. Ragusa
<input checked="" type="checkbox"/> Attorney/Agent (Reg. No.) 38,587	Typed name of signer
<input type="checkbox"/> Common Representative	 Signature

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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ US

# PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND	
<b>Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION</b>		Applicant's or agent's file reference 32095-PCT	
International application No. PCT/US99/26125	International filing date (day/month/year) 05 November 1999 ( 05.11.99 )	(Earliest) Priority date (day/month/year) 06 November 1998 ( 06.11.98 )	
Title of invention SYSTEMS AND METHODS FOR INTEROPERABLE MULTIMEDIA CONTENT DESCRIPTIONS			
<b>Box No. II APPLICANT(S)</b>			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK Broadway and 116th Street New York, NY 10027 US		Telephone No.:	
		Facsimile No.:	
		Teleprinter No.:	
State (that is, country) of nationality: US		State (that is, country) of residence: US	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  PAEK, SEUNGYUP 530 Riverside Drive, Apt. 6J New York, NY 10027 US			
State (that is, country) of nationality: KR		State (that is, country) of residence: US	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  BENITEZ, ANA 400 West 119th Street, Apt. 9F New York, NY 10027 US			
State (that is, country) of nationality: ES		State (that is, country) of residence: US	
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.			

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## Continuation of Box No. II APPLICANT(S)

*If none of the following sub-boxes is used, this sheet is not to be included in the demand.*

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

CHANG,SHIH-FU  
560 Riverside Drive, Apt. 18K  
New York, NY 10027  
US

State *(that is, country)* of nationality:  
TW

State *(that is, country)* of residence:  
US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

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**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is ☒ agent ☐ common representative  
 and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.  
☐ is hereby appointed and any earlier appointment of (an) agent(s) /common representative is hereby revoked.  
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

TANG, HENRY and  
 RAGUSA, PAUL A.  
 Baker Botts LLP  
 30 Rockefeller Plaza  
 New York, NY 10112-0228  
 US

Telephone No.:

(212) 705-5000

Facsimile No.:

(212) 705-5020

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:\***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filed

the description ☒ as originally filed

☐ as amended under Article 34

the claims ☐ as originally filed

☒ as amended under Article 19 (together with any accompanying statement)

☐ as amended under Article 34

the drawings ☒ as originally filed

☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

\* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

**Language for the purposes of international preliminary examination: English**

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

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**Box No. VI CHECK LIST**

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- |  |   |          |
|--|---|----------|
| 1. translation of international application                              | : | sheets   |
| 2. amendments under Article 34   | : | sheets   |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | 4 sheets |
| 4. copy (or, where required, translation) of statement under Article 19  | : | sheets   |
| 5. letter  | : | sheets   |
| 6. other ( <i>specify</i> )  | : | sheets   |

For International Preliminary Examining Authority use only

received not received

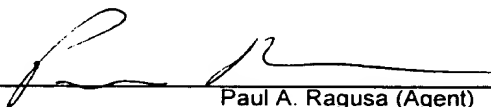
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<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- |  |   |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet                             | 4. <input type="checkbox"/> statement explaining lack of signature                                  |
| 2. <input type="checkbox"/> separate signed power of attorney                            | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input checked="" type="checkbox"/> other ( <i>specify</i> ): Transmittal Letter                 |

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

  
Paul A. Ragusa (Agent)

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only


Demand received from IPEA on:

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## PCT

## FEE CALCULATION SHEET

## Annex to the Demand for international preliminary examination

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">International application No.</td> <td style="width: 50%;">PCT/US99/26125</td> </tr> <tr> <td>Applicant's or agent's file reference</td> <td>32095-PCT</td> </tr> </table>	International application No.	PCT/US99/26125	Applicant's or agent's file reference	32095-PCT	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="height: 40px; vertical-align: top;">For International Preliminary Examining Authority use only</td> </tr> <tr> <td style="height: 40px; vertical-align: top;">Date stamp of the IPEA</td> </tr> </table>	For International Preliminary Examining Authority use only	Date stamp of the IPEA												
International application No.	PCT/US99/26125																		
Applicant's or agent's file reference	32095-PCT																		
For International Preliminary Examining Authority use only																			
Date stamp of the IPEA																			
Applicant <b>THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK</b>																			
<b>Calculation of prescribed fees</b>  <table style="width: 100%;"> <tr> <td style="width: 60%;">1. Preliminary examination fee .....</td> <td style="width: 20%; text-align: right;">490.00</td> <td style="width: 20%; text-align: center;">P</td> </tr> <tr> <td colspan="3" style="height: 20px;"></td> </tr> <tr> <td>2. Handling fee (<i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i>) .....</td> <td style="text-align: right;">153.00</td> <td style="text-align: center;">H</td> </tr> <tr> <td colspan="3" style="height: 20px;"></td> </tr> <tr> <td>3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box .....</td> <td style="text-align: right; border: 1px solid black;">643.00</td> <td></td> </tr> <tr> <td></td> <td style="text-align: right; border: 1px solid black;">TOTAL</td> <td></td> </tr> </table>		1. Preliminary examination fee .....	490.00	P				2. Handling fee ( <i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> ) .....	153.00	H				3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box .....	643.00			TOTAL	
1. Preliminary examination fee .....	490.00	P																	
2. Handling fee ( <i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> ) .....	153.00	H																	
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box .....	643.00																		
	TOTAL																		
<b>Mode of Payment</b>  <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)  <input checked="" type="checkbox"/> cheque  <input type="checkbox"/> postal money order  <input type="checkbox"/> bank draft         </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> cash  <input type="checkbox"/> revenue stamps  <input type="checkbox"/> coupons  <input type="checkbox"/> other (specify):         </td> </tr> </table>		<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below) <input checked="" type="checkbox"/> cheque <input type="checkbox"/> postal money order <input type="checkbox"/> bank draft	<input type="checkbox"/> cash <input type="checkbox"/> revenue stamps <input type="checkbox"/> coupons <input type="checkbox"/> other (specify):																
<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below) <input checked="" type="checkbox"/> cheque <input type="checkbox"/> postal money order <input type="checkbox"/> bank draft	<input type="checkbox"/> cash <input type="checkbox"/> revenue stamps <input type="checkbox"/> coupons <input type="checkbox"/> other (specify):																		
<b>Deposit Account Authorization</b> ( <i>this mode of payment may not be available at all IPEAs</i> )  The IPEA/ <u>US</u> <input type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account.  <input checked="" type="checkbox"/> ( <i>this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit</i> ) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.																			
02-4377 Deposit Account Number	17 May 2000 Date (day/month/year)	 Signature																	

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## PCT COOPERATION TREATY

32095  
PCT

PCT

NOTIFICATION CONCERNING  
SUBMISSION OR TRANSMITTAL  
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

BAKER BOTTS L.L.P.

00 JAN 21 PM 2: 15

TANG, Henry  
Baker & Botts, LLP  
30 Rockefeller Plaza  
New York, NY 10112-0228  
ÉTATS-UNIS D'AMÉRIQUE

TO

HEIT DTR  
DTR me

Date of mailing (day/month/year) 10 January 2000 (10.01.00)	
Applicant's or agent's file reference 32095-PCT	IMPORTANT NOTIFICATION
International application No. PCT/US99/26125	International filing date (day/month/year) 05 November 1999 (05.11.99)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 06 November 1998 (06.11.98)
Applicant THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(\*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
06 Nove 1998 (06.11.98)	60/107,463	US	28 Dece 1999 (28.12.99)

COPY TO  
HEIT 11/25

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Marc Salzman
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: HENRY TANG  
BAKER & BOTTS, LLP  
30 ROCKEFELLER PLAZA  
NEW YORK NY 10112-0228

## PCT

### NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 32095-PCT	Date of Mailing (day/month/year) <b>03 APR 2000</b>
International application No. PCT/US99/26125	International filing date (day/month/year) 05 NOVEMBER 1999
Applicant THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK	

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.  
**Filing of amendments and statement under Article 19:**  
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):  

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.  
  
**Where?** Directly to the International Bureau of WIPO  
                     34, chemin des Colombettes  
                     1211 Geneva 20, Switzerland  
                     Facsimile No.: (41-22) 740.14.35  
  
 For more detailed instructions, see the notes on the accompanying sheet.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
 

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.  
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Further action(s):** The applicant is reminded of the following:  
 Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 bis 1 and 90 bis 3, respectively, before the completion of the technical preparations for international publication.  
  
 Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).  
  
 Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231  Facsimile No. (703) 305-3230	Authorized officer  Thomas G. Black  Telephone No. (703) 305-9707
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**INTERNATIONAL COOPERATION TREATY**

**PCT**

**INTERNATIONAL SEARCH REPORT**

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 32095-PCT	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US99/26125	International filing date ( <i>day/month/year</i> ) 05 NOVEMBER 1999	(Earliest) Priority Date ( <i>day/month/year</i> ) 06 NOVEMBER 1998
Applicant THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (Sec Box I).
2. ☐ Unity of invention is lacking (Sec Box II).
3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
  - ☐ filed with the international application.
  - ☐ furnished by the applicant separately from the international application,
    - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
  - ☐ transcribed by this Authority.
4. With regard to the title,
  - ☒ the text is approved as submitted by the applicant.
  - ☐ the text has been established by this Authority to read as follows:
5. With regard to the abstract,
  - ☐ the text is approved as submitted by the applicant.
  - ☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
 

Figure No. 1

  - ☐ as suggested by the applicant.
  - ☒ because the applicant failed to suggest a figure.
  - ☐ because this figure better characterizes the invention.
  - ☐ None of the figures.

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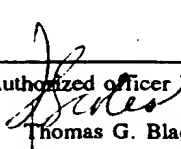
**Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)**

Systems and methods for generating standard description records from multimedia information are provided. The system includes at least one multimedia information input interface (180) receiving multimedia information, a computer processor, and a data storage system(150), operatively coupled to said processor, for storing said at least one description record. The processor performs object extraction processing to generate multimedia object descriptions (200, 201, 205) from the multimedia information, and object hierarchy processing (410, 420) to generate multimedia object hierarchy descriptions, to generate at least one description record including the multimedia object descriptions (200, 201, 205) and multimedia object hierarchy descriptions for content embedded within the multimedia information.

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/26125

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(6) : G06F/1730 US CL : 707/10, 3, 4, 5, 104; 386/69; 395/806 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 707/10, 3, 4, 5, 104; 386/69; 395/806  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WEST, EAST		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,613,032 A (CRUZ et al.) 18 March 1997, col. 3, line 30-col. 4, line 44).	1-43
Y	US 5,623,690 A (PALMER et al) 22 April 1997, col. 1, lines 52-66.	1-43
Y	US 5,630,121 A (BRADEN-HARDER et al.) 13 May 1997, col. 2, line 54-col. 3, line 28.	1-43
Y	US 5,696,964 A (COX et al) 09 December 1997, col. 1, lines 8-11.	1
Y	US 5,701,510 A (JOHNSON et al) 23 December 1997, col. 1, line 51-col. 2, line 17.	1-43
Y	US 5,713,021 A (KONDO et al) 27 January 1998, col. 1, line 55-col. 2, line 14.	1-43
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier document published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	*T* "X" "Y" "A*" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
Date of the actual completion of the international search 10 FEBRUARY 2000		Date of mailing of the international search report 03 APR 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer  Thomas G. Black Telephone No. (703) 305-9707

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/26125

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,758,076 A (WU et al) 26 May 1998, col. 1, lines 6-11.	1
Y	US 5,805,804 A (LAURSEN et al) 08 September 1998, col. 2, lines 14-38.	1-43
Y	US 5,822,524 A (CHEN et al) 13 October 1998, col. 3, line 40-col. 4, line 44.	1-43
Y	US 5,642,477 A (DE CARMO et al) 24 June 1997, col. 1, lines 10-14.	1
Y	US 5,713,021 A (KONDO et al) 27 January 1998, col. 1, line 56-col. 2, line 14.	1

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## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

Receiving Office use only	
International Application No.	
International Filing Date	09/830899
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum)	32095-PCT

<b>Box No. I TITLE OF INVENTION</b> SYSTEMS AND METHODS FOR INTEROPERABLE MULTIMEDIA CONTENT DESCRIPTIONS	
<b>Box No. II APPLICANT</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)  THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK Broadway & 116th Street New York, NY 10027 US	<input type="checkbox"/> This person is also inventor.  Telephone No.  Facsimile No.  Teleprinter No.
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<b>Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)  PAEK, SEUNGYUP 530 Riverside Drive, Apt. 6J New York, NY 10027 US	This person is:  <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)
State (that is, country) of nationality: KR	State (that is, country) of residence: US
This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box	
<input checked="" type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.	
<b>Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE</b>	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  TANG, HENRY Baker & Botts, LLP 30 Rockefeller Plaza New York, NY 10112-0228 US	Telephone No. (212) 705-5000  Facsimile No. (212) 705-5020  Teleprinter No.
<input type="checkbox"/> Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

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## Continuation of Box No. 1. FURTHER APPLICANTS AND/OR (FURTHER) INVENTOR(S)

*If none of the following sub-boxes is used, this sheet is not to be included in the request.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

BENITEZ, ANA  
400 West 119th Street, Apt. 9F  
New York, NY 10027  
US

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
ES

State (that is, country) of residence:  
US

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

CHANG, SHIH-FU  
560 Riverside Drive, Apt. 18K  
New York, NY 10027  
US

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
TW

State (that is, country) of residence:  
US

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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**Box No.V DESIGNATION STATES**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

**National Patent (if other kind of protection or treatment desired, specify on dotted line):**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates                  | <input checked="" type="checkbox"/> LR Liberia   |
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LS Lesotho   |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LT Lithuania   |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> LU Luxembourg  |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> LV Latvia  |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> MD Republic of Moldova   |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MG Madagascar  |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia                             |
| <input checked="" type="checkbox"/> BG Bulgaria                              |  |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MN Mongolia  |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> MW Malawi  |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> MX Mexico  |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> NO Norway  |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> NZ New Zealand   |
| <input checked="" type="checkbox"/> CU Cuba                                  | <input checked="" type="checkbox"/> PL Poland  |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> PT Portugal  |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> RO Romania   |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> RU Russian Federation  |
| <input checked="" type="checkbox"/> EE Estonia                               | <input checked="" type="checkbox"/> SD Sudan   |
| <input checked="" type="checkbox"/> ES Spain                                 | <input checked="" type="checkbox"/> SE Sweden  |
| <input checked="" type="checkbox"/> FI Finland                               | <input checked="" type="checkbox"/> SG Singapore   |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> SI Slovenia  |
| <input checked="" type="checkbox"/> GD Grenada                               | <input checked="" type="checkbox"/> SK Slovakia  |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> SL Sierra Leone  |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TJ Tajikistan  |
| <input checked="" type="checkbox"/> GM Gambia                                | <input checked="" type="checkbox"/> TM Turkmenistan  |
| <input checked="" type="checkbox"/> HR Croatia                               | <input checked="" type="checkbox"/> TR Turkey  |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> TT Trinidad and Tobago   |
| <input checked="" type="checkbox"/> ID Indonesia                             | <input checked="" type="checkbox"/> UA Ukraine   |
| <input checked="" type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> UG Uganda  |
| <input checked="" type="checkbox"/> IN India                                 | <input checked="" type="checkbox"/> US United States of America  |
| <input checked="" type="checkbox"/> IS Iceland                               |  |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> UZ Uzbekistan  |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> VN Viet Nam  |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> YU Yugoslavia  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> ZA South Africa  |
|  | <input checked="" type="checkbox"/> ZW Zimbabwe  |
| <input checked="" type="checkbox"/> KR Republic of Korea                     | Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            | <input checked="" type="checkbox"/> CR Costa Rica  |
| <input checked="" type="checkbox"/> LC Saint Lucia                           | <input checked="" type="checkbox"/> DM Dominica  |
| <input checked="" type="checkbox"/> LK Sri Lanka                             | <input checked="" type="checkbox"/> TZ Tanzania  |
|  | <input checked="" type="checkbox"/> MA Morocco   |

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

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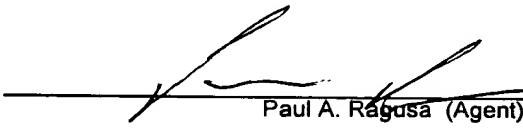
<b>Box No. VI PRIORITY</b>		<input type="checkbox"/> Further priority are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application:* regional Office	international application: receiving Office
item (1) 06 November 1998 (06.11.98)	60/107,463	US		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): (1)

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>	
Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):	Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):
ISA/ us	Date (day/month/year) Number Country (or regional Office)

<b>Box No. VIII CHECK LIST: LANGUAGE OF FILING</b>	
This international application contains the following number of sheets:	This international application is accompanied by the item(s) marked below:
request : 4	1. <input checked="" type="checkbox"/> fee calculation sheet
description (excluding sequence listing part) : 52	2. <input type="checkbox"/> separate signed power of attorney
claims : 11	3. <input type="checkbox"/> copy of general power of attorney; reference number, if any:
abstract : 1	4. <input type="checkbox"/> statement explaining lack of signature
drawings : 8	5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):
sequence listing part of description : _____	6. <input type="checkbox"/> translation of international application into (language):
Total number of sheets : 76	7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material
	8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form
	9. <input checked="" type="checkbox"/> other (specify):
Figure of the drawings which should accompany the abstract:	Language of filing of the international application: English

<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>	
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).	
 Paul A. Ragusa (Agent)	

For receiving Office use only		2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA/	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid	

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	

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# PCT

## FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's  
file reference

32095-PCT

Applicant

THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

### CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE .....

240.00 T

2. SEARCH FEE .....

450.00 S

International search to be carried out by US

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

#### Basic Fee

The international application contains 76 sheets.

first 30 sheets ..... 455.00 b<sub>1</sub>

46 x \$10.00 = 460.00 b<sub>2</sub>  
remaining sheets additional amount

Add amounts entered at b<sub>1</sub> and b<sub>2</sub> and enter total at B ..... 915.00 B

#### Designation Fees

The international application contains 106 designations.

10 x 105.00 = 1,050.00 D  
number of designation fees amount of designation fee

payable (maximum 10)

Add amounts entered at B and D and enter total at I ..... 1,965.00 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled,

4. FEE FOR PRIORITY DOCUMENT (if applicable) ..... 15.00 P

5. TOTAL FEES PAYABLE

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

2,900.00

TOTAL

☐ The designation fees are not paid at this time.

### MODE OF PAYMENT

☐ authorization to charge  
deposit account (see below)

☐ bank draft

☐ coupons

☒ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

### DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO/ US ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☒ (this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

02-4377

5 November 1999

Deposit Account Number

Date (day/month/year)

Signature

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# PATENT COOPERATION TREATY

From the RECEIVING OFFICE

## PCT

To:

HENRY TANG  
BAKER & BOTTS, LLP  
30 ROCKEFELLER PLAZA  
NEW YORK NY 10112-0228

### NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

Date of mailing  
(day/month/year)

**09 DEC 1999**

Applicant's or agent's file reference  
**32095-PCT**

#### IMPORTANT NOTIFICATION

International application No.

**PCT/US99/26125**

International filing date (day/month/year)

**05 NOV 99**

Priority date (day/month/year)

**06 NOV 98**

Applicant **THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF  
NEW YORK**

Title of the invention **SYSTEMS AND METHODS FOR INTEROPERABLE MULTIMEDIA  
CONTENT DESCRIPTIONS**

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:



was transmitted to the International Bureau on

**09 DEC 1999**



has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau\*:



because the necessary national security clearance has not yet been obtained.



because (reason to be specified):

\* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

#### 3. FOREIGN TRANSMITTAL LICENSE INFORMATION

Completed by: *[Signature]*



Additional license for foreign transmittal not required. This subject matter is covered by a license already granted on the equivalent U.S. national application. Refer to that license for information concerning its scope.



License for foreign transmittal not required. 37 CFR 5.11(e)(1) or 37 CFR 5.11(e)(2). However, a license may be required for additional subject matter. See 37 CFR 5.15(b).



Foreign transmittal license granted. 35 U.S.C. 184; 37 CFR 5.11 on **11-19-99** :  
(date)



37 CFR 5.15(a)



37 CFR 5.15(b)

Name and mailing address of the receiving Office  
Assistant Commissioner for Patents  
Box PCT  
Washington, D.C. 20231  
Facsimile No.

Attn: RO/US

Authorized officer

*[Signature]*  
**Felicia Lawrence**  
PCT Operations - IPD Team 1  
703) 305-3675 (703) 305-3230 (FAX)

Telephone No.

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## PATENT COOPERATION TREATY

32.095  
PCT

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF RECEIPT OF  
RECORD COPY

(PCT Rule 24.2(a))

To:

TANG, Henry  
Baker & Botts, LLP  
30 Rockefeller Plaza  
New York, NY 10112-0228  
ÉTATS-UNIS D'AMÉRIQUE

BAKER BOTTS L.L.P.

00 JAN 11 AM 10:42

Date of mailing (day/month/year) 20 December 1999 (20.12.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 32095-PCT	International application No. PCT/US99/26125

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK (for all designated  
States except US)  
PAEK, Seungyup et al (for US)

International filing date : 05 November 1999 (05.11.99)  
Priority date(s) claimed : 06 November 1998 (06.11.98)  
Date of receipt of the record copy  
by the International Bureau : 13 December 1999 (13.12.99)  
List of designated Offices :

AP : GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW  
EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM  
EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE  
OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG  
National : AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB,  
GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK,  
MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA,  
ZW

COPY TO

Heft

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: J. Leitao
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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## Continuation of Form PCT/IB/301

## NOTIFICATION OF RECEIPT OF RECORD COPY

<b>Date of mailing (day/month/year)</b> 20 December 1999 (20.12.99)	<b>IMPORTANT NOTIFICATION</b>
<b>Applicant's or agent's file reference</b> 32095-PCT	<b>International application No.</b> PCT/US99/26125

**ATTENTION**

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase
- ☐ confirmation of precautionary designations
- ☒ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

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## INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated in the Notification of Receipt of Record Copy (Form PCT/IB/301) by paying national fees and furnishing translations, as prescribed by the applicable national laws.

The time limit for performing these procedural acts is **20 MONTHS** from the priority date or, for those designated States which the applicant elects in a demand for international preliminary examination or in a later election, **30 MONTHS** from the priority date, provided that the election is made before the expiration of 19 months from the priority date. Some designated (or elected) Offices have fixed time limits which expire even later than 20 or 30 months from the priority date. In other Offices an extension of time or grace period, in some cases upon payment of an additional fee, is available.

In addition to these procedural acts, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure that the necessary steps to enter the national phase are taken in a timely fashion. Most designated Offices do not issue reminders to applicants in connection with the entry into the national phase.

For detailed information about the procedural acts to be performed to enter the national phase before each designated Office, the applicable time limits and possible extensions of time or grace periods, and any other requirements, see the relevant Chapters of Volume II of the PCT Applicant's Guide. Information about the requirements for filing a demand for international preliminary examination is set out in Chapter IX of Volume I of the PCT Applicant's Guide.

GR and ES became bound by PCT Chapter II on 7 September 1996 and 6 September 1997, respectively, and may, therefore, be elected in a demand or a later election filed on or after 7 September 1996 and 6 September 1997, respectively, regardless of the filing date of the international application. (See second paragraph above.)

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date. If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with an indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

## REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity to furnish the priority document within a time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

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# PATENT COOPERATION TREATY

32095  
PCT

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: HENRY TANG  
BAKER BOTTS LLP  
30 ROCKEFELLER PLAZA  
NEW YORK, NY 10112-0228

**PCT** BAKER BOTTS L.L.P.

00 DEC 14 PM 4:30  
NOTIFICATION OF TRANSMITTAL OF  
INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing  
(day/month/year)

07 DEC 2000

Applicant's or agent's file reference

32095-PCT

IMPORTANT NOTIFICATION

International application No.

PCT/US99/26125

International filing date (day/month/year)

05 NOVEMBER 1999

Priority Date (day/month/year)

06 NOVEMBER 1998

Applicant

THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

ON DOCUMENT FOR  
5/6/01

Name and mailing address of the IPEA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

Thomas G. Black

Telephone No. (703) 305-9707

*James R. Matthews*

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>32095-PCT</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/US99/26125</b>	International filing date ( <i>day/month/year</i> ) <b>05 NOVEMBER 1999</b>	Priority date ( <i>day/month/year</i> ) <b>06 NOVEMBER 1998</b>
International Patent Classification (IPC) or national classification and IPC <b>IPC(7): GO6F 17/30 and US Cl.: 707/10, 3, 4, 5, 104; 386/69; 395/806</b>		
Applicant <b>THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK</b>		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u>3</u> sheets.  <input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  These annexes consist of a total of <u>0</u> sheets.
3.	This report contains indications relating to the following items: <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step or industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>

Date of submission of the demand  <b>17 MAY 2000</b>	Date of completion of this report  <b>08 AUGUST 2000</b>
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231  Facsimile No. (703) 305-3230	Authorized officer  Thomas G. Black <i>James R. Matthews</i> Telephone No. (703) 305-9707

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/26125

**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☒ the international application as originally filed
- ☒ the description:  
pages 1-49 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the claims:  
pages 50-60 , as originally filed  
pages NONE , as amended (together with any statement) under Article 19  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the drawings:  
pages 1-6 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the sequence listing part of the description:  
pages NONE , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:**

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☒ The amendments have resulted in the cancellation of:**

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

**5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\*Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/26125

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. statement**

Novelty (N)

Claims 1-43 YESClaims NONE NO

Inventive Step (IS)

Claims 1-43 YESClaims NONE NO

Industrial Applicability (IA)

Claims 1-43 YESClaims NONE NO**2. citations and explanations (Rule 70.7)**

Claims 1-43 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a system for generating a description record from multimedia information wherein at least one description record including said multimedia object description and said multimedia object hierarchy description is generated for content embedded within said multimedia information.

----- NEW CITATIONS -----

NONE

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# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

### NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rule 59.3(e) and 61.1(b), first sentence  
and Administrative Instructions, Section 601(a))

To

HENRY TANG  
BAKER & BOTTS, LLP  
30 ROCKEFELLER PLAZA  
NEW YORK NY 10112-0228

Date of mailing  
(day/month/year)

22 JUN 2000

Applicant's or agent's file reference  
32095-PCT

#### IMPORTANT NOTIFICATION

International application No.  
PCT/US99/26125

International filing date (day/month/year)  
05 NOV 99

Priority date (day/month/year)  
06 NOV 98

Applicant

THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF  
NEW YORK

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

17 May 2000 (17.05.00)

2. That date of receipt is:



the actual date of receipt of the demand by this Authority (Rule 61.1(b)).



the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).



the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.



(If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau 5/16/00

Name and mailing address of the IPEA/US  
Assistant Commissioner for Patents  
Box PCT  
Washington, D.C. 20231  
Facsimile No.

Attn: IPEA/US

Authorized officer

Marilyn Younger  
PCT Operations - IAPD Team 1

Telephone No. (703) 305-3753 (703) 305-3230 (FAX)

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## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

**NOTIFICATION CONCERNING  
THE FILING OF AMENDMENTS OF THE CLAIMS**  
(PCT Administrative Instructions, Section 417)

To:

TANG, Henry  
Baker & Botts, LLP  
30 Rockefeller Plaza  
New York, NY 10112-0228  
ETATS-UNIS D'AMERIQUE

BAKER BOTTS L.L.P.

00 MAY 30 PM 12: 59

<b>Date of mailing</b> (day/month/year) 16 May 2000 (16.05.00)	
<b>Applicant's or agent's file reference</b> 32095-PCT	<b>IMPORTANT NOTIFICATION</b>
<b>International application No.</b> PCT/US99/26125	<b>International filing date</b> (day/month/year) 05 November 1999 (05.11.99)
<b>Applicant</b> THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK et al	

1. The applicant is hereby notified that amendments to the claims under Article 19 were received by the International Bureau on:

12 May 2000 (12.05.00)

2. This date is within the time limit under Rule 46.1.

Consequently, the international publication of the international application will contain the amended claims according to Rule 48.2(f), (h) and (i).

3. The applicant is reminded that the international application (description, claims and drawings) may be amended during the international preliminary examination under Chapter II, according to Article 34, and in any case, before each of the designated Offices, according to Article 28 and Rule 52, or before each of the elected Offices, according to Article 41 and Rule 78.

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorised officer</p> <p>Dominique DELMAS</p> <p>Telephone No.: (41-22) 338.83.38</p>
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## PATENT COOPERATION TREATY

BAKER BOTTS LLP

32095

PCT

From the INTERNATIONAL BUREAU 7 PM 12: 02

To:

TANG, Henry  
Baker & Botts, LLP  
30 Rockefeller Plaza  
New York, NY 10112-0228  
ETATS-UNIS D'AMERIQUE

# INFORMATION CONCERNING ELECTED OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

Date of mailing (day/month/year) 26 July 2000 (26.07.00)		
Applicant's or agent's file reference 32095-PCT		IMPORTANT INFORMATION
International application No. PCT/US99/26125	International filing date (day/month/year) 05 November 1999 (05.11.99)	
		Priority date (day/month/year) 06 November 1998 (06.11.98)
Applicant THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK et al		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, BR, CA, CN, CZ, DE, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AE, AL, AM, AT, AZ, BA, BB, BY, CH, CR, CU, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM,  
HR, HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MW, MX, PT, SD, SG,  
SI, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

3. The applicant is reminded that he must enter the "national phase" **before the expiration of 30 months from the priority date** before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume I of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until **31 months from the priority date** for all States designated for the purposes of obtaining a European patent.

ON DOCKET FOR  
5/16/01  
Deadline - Chapter II

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Jean-Marie McAdams
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE  
COMMUNICATION OF THE INTERNATIONAL  
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

TANG, Henry  
Baker & Botts, LLP  
30 Rockefeller Plaza  
New York, NY 10112-0228  
ETATS-UNIS D'AMERIQUE

BAKER BOTTS L.L.P.

00 MAY 30 PM 1:00

Date of mailing (day/month/year) 18 May 2000 (18.05.00)		IMPORTANT NOTICE TO	
Applicant's or agent's file reference 32095-PCT			
International application No. PCT/US99/26125	International filing date (day/month/year) 05 November 1999 (05.11.99)	Priority date (day/month/year) 06 November 1998 (06.11.98)	
Applicant THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:  
AU,CN,JP,KP,KR,MA,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,  
GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,  
PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on  
18 May 2000 (18.05.00) under No. WO 00/28440

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

ON DOCKET FOR

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer J. Zahra Telephone No. (41-22) 338.83.38
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